

Pit and Quarry

**SAND-GRAVEL-STONE
CEMENT-LIME-GYPSUM**

PORTER LOCOMOTIVES



For Quarry Service—regardless of conditions—there's no locomotive that surpasses a PORTER—either in performance, or maintenance economies.

Our new Quarry Bulletin will be mailed on request

H. K. Porter Company

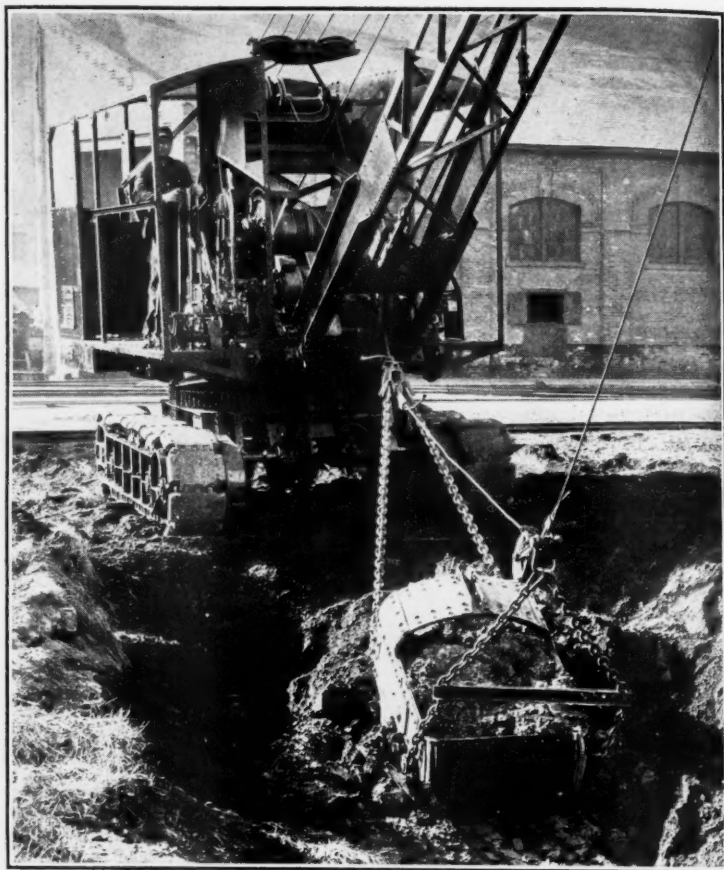
Pittsburgh, Penna.

March 1, 1926

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Circulation 7,500



It looks like hard digging —and it is

Other Products:—

Locomotive cranes
5-200 tons capacity,
freight cranes, pile
drivers and clam-
shell buckets.

BUT it is easy for the INDUSTRIAL type DC crawling tractor dragline. Why? Because its power is ample for the most severe dragline service—its design is the result of years of experience building this sort of equipment and the materials used in its construction are the best that money can buy. Built into INDUSTRIALS is that *stamina* to withstand the ravages of years of constant service.

The DC is also a crane and a shovel and as such it is an all purpose machine that will conquer any material handling problem. Its first cost is surprisingly low—its final cost the lowest.

Steam Gasoline Electric Diesel

Write for Book 120-A

INDUSTRIAL WORKS · BAY CITY · MICHIGAN

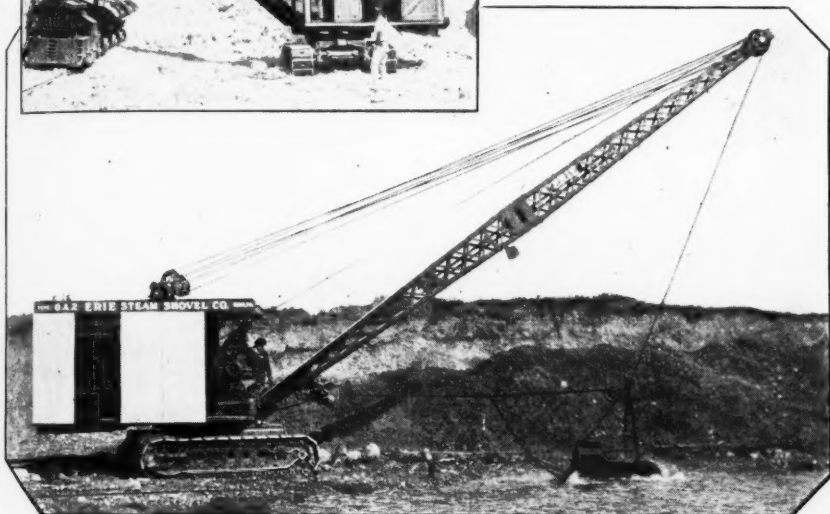
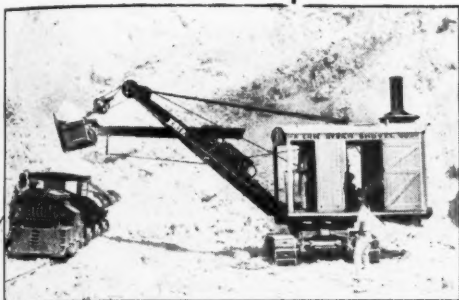


Steam or Gas Power
the same **RELIABILITY**

Much better service than other shovels

"Our 6 ERIES are all giving excellent results loading limestone, and stripping overburden. The ERIE is strictly reliable with an exceedingly small upkeep cost. Gives much better service than other shovels."— C. G. Rose, Gen. Mgr. Ocala Lime Rock Co., Ocala, Fla.

You have heard hundreds of reports like this. ERIE Shovels work with a reliability which has no parallel. 3700 ERIES now in service— far more revolving shovels than of any other make. Write for Bulletin Q-80.



ERIE Gas + Air Dragline Doing Very Fine Work

Reports keep coming in from all parts of the country telling of the splendid work that Gas+Air ERIES are doing:

"Other types of draglines do not compare with the Gas+Air ERIE. It is much more powerful— doing very fine work."— Grand Rapids Gravel Co., Grand Rapids, Mich. (5 ERIES)

Here's one gas dragline that can

pull the bucket with the *full power of its big direct-connected 4-cylinder gasoline engine, while swinging at the full power of its direct-connected air engines, at the same time.* Has the simplicity and ruggedness of a steam ERIE— and is equally good as shovel or clamshell excavator.

Watch a Gas+Air ERIE work, and draw your own conclusions.

ERIE STEAM SHOVEL CO., Erie, Pa., U. S. A.

Builders of ERIE Shovels, Cranes, Ditchers, Draglines, Trench Hoes, etc.

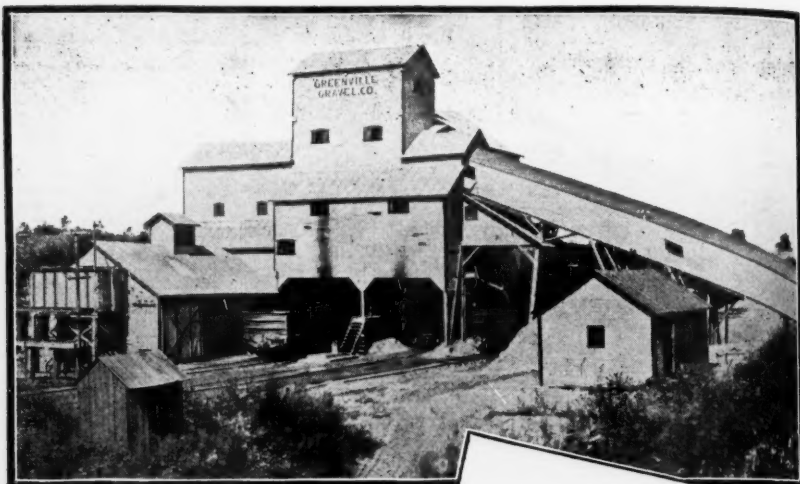
Branch Offices: Boston, New York, Philadelphia, Pittsburgh, Atlanta, Chicago
Representatives throughout the U. S. A.

ERIE

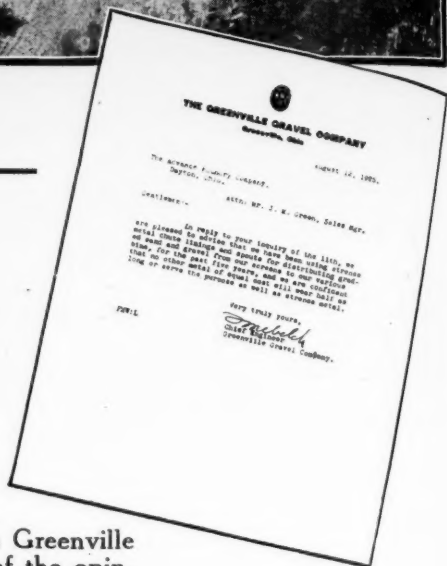
Fully
protected
by basic
patents

GAS + AIR

Shovel
and Crane



Evidence— Only One Of Many



This letter from the Greenville Gravel Co. is typical of the opinion expressed by all users of Strenes Chutes and Liners.

To quote only this one company: "No other metal of equal cost will wear half as long or serve the purpose as well as Strenes Metal."

Write for Bulletin 26-P for further evidence

The Advance Foundry Co.

DAYTON, OHIO



Nothing Little about the Koehring

COMPACTNESS of appearance means scientific distribution of weight. It is one of the *proofs* of scientific design! The Koehring is more symmetrical—more compact and every gear, every clutch, every angle, every detail is literally *oversize*—as demanded for the full standard of Koehring Heavy Duty construction!

Steer the Koehring as easily as you steer a truck!

Crowd the Dipper beyond and above the end of boom! Independent crowd makes possible high lift with short boom! Automatic adjustment of crowding cables puts bucket at instant command of operator for shallow grading, deep digging, or high bank work. Finger-tip control means extra capacity.

Shovel Capacities

No. 1— $\frac{3}{4}$ cu. yd. dipper, struck measure, on 19 ft. 6 in. boom with 16 ft. dipper sticks. 4 cylinder, 5x6 in. gasoline engine, 1100 R. P. M.

No. 2— $1\frac{1}{4}$ cu. yd. dipper, struck measure, on 20 ft. 7 in. boom, with 16 ft. dipper sticks. 4 cylinder, 6x7 in. gasoline engine, 925 R. P. M.

Write for Shovel Bulletin No. S. 32

KOEHRING COMPANY

PAVERS, MIXERS—GASOLINE SHOVELS,
CRANES AND DRAGLINES

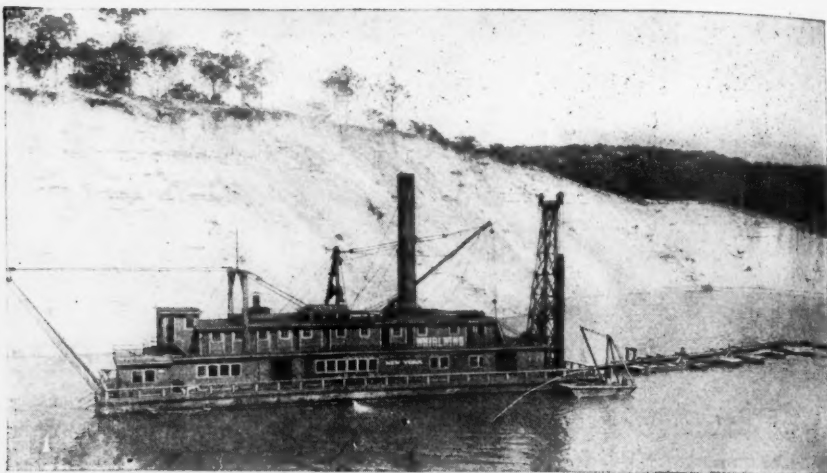
MILWAUKEE WISCONSIN

Sales Offices and Service Warehouses in all principal cities

Foreign Dept., Room 1370, 50 Church St.
New York City

Canada, Koehring Co. of Canada, Ltd.,
105 Front St., East, Toronto, Ontario
Mexico, F. S. Lapum, Cino De Mayo 21,
Mexico, D. F.

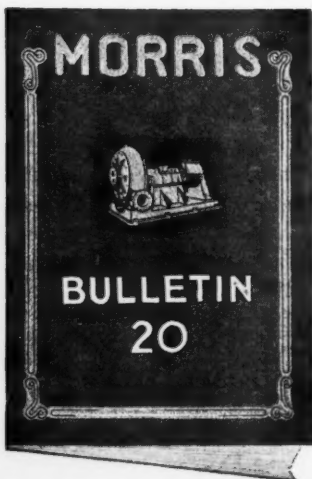
A 3073-III-IV



There's big money in a bank like this if you take out the sand and gravel with a

MORRIS DREDGE

THE water does the cleansing and the dredging pump does the work: Result, the finest quality of sand and gravel that money can buy—the kind your customer is willing to pay a little extra for because it is well worth the difference.



Sent **FREE** if you return the coupon

By means of an extra boosting pump, if necessary, the production can be raised to sorting screens and dropped clean and well graded into scow, freight car or motor truck—all at a ridiculously low cost per cubic yard because very little attendance is required and the pumps consume power only in doing useful work. During the rush season your production capacity is limited only by the number of hours the plant is operated, and once the delivery capacity is proven, you can calculate to a nicety how long it will take to complete any contract. If the raw material becomes exhausted in one location, it's an easy matter to pull up and move to another.

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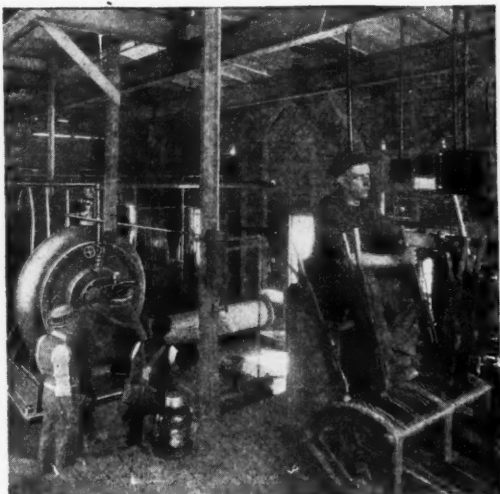
Orig
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Brande
adelph
Chicag
St. L
scot
Main
Sales
City,
Ang

If you want this business-like procedure, freedom from labor and handling worries, and assurance of good and steady profits on all the production you can sell, you can't put a Morris dredge to work too soon.

We furnish the dredge complete or the pumping equipment with plans from which you can build yourself at point of service.

Morris Engineers will advise you gladly and without charge as to what type and size of pumps you should use for jetting, dredging, conveying and boosting.



Tell us your conditions or at least ask for Bulletin 20.

**Originators of Centrifugal pumps,
both single and multi-stage, and
builders for practically all pur-
poses since 1864**

Branch offices: New York, 39-41 Cortlandt St.; Philadelphia, Forest Bldg.; Cleveland, Engineers' Bldg.; Chicago, 217 N. Jefferson St.; Boston, 79 Milk St.; Pittsburgh, 320 Second Ave.; Detroit, Penobscot Bldg.; Charlotte, Realty Bldg.; Houston, 119 Main St.

Sales Representatives: Buffalo, St. Paul, Kansas City, Denver, Salt Lake City, Portland, Ore.; Los Angeles, New Orleans.

Morris Machine Works,
Baldwinsville, N. Y.
Please send Bulletin 20.

Name.....

Firm.....

Address.....

P&Q.....

MORRIS

CENTRIFUGAL PUMPS



You Ought to See the 120-B *In the Meantime* Send for this Book

The new Bucyrus 120-B 4-yard full revolving shovel is hard to describe. When it was built we sent descriptions of it to veteran quarrymen, veteran excavators.

When they saw the machine they were amazed by the snap and go, the brute strength and sheer power of the thing.

Prepared for something new in shovels, they were totally unprepared for the Bucyrus 120-B.

So far as the modern printing art permits, we have shown this shovel from boom sheave to caterpillar track, with all its great strength, speed, power and mobility, in the new 120-B bulletin.

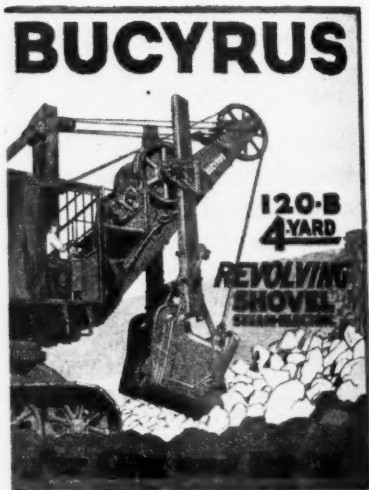
In this bulletin pages are devoted to the single huge base and revolving frame castings of steel, the extraordinary boom, and other great features of the new 120-B Bucyrus. It will interest every shovel user.

You will want to see the machine in action. It is revolutionizing quarry operation. It is replacing the railroad shovel in Mine and Quarry. In the meantime shall we send you this book? Ask for Bulletin D1202-A.

BUCYRUS COMPANY

South Milwaukee,

Wisconsin



BUCYRUS

NEW YORK

CHICAGO

BIRMINGHAM

SAN FRANCISCO

PITTSBURGH

TOKYO

LONDON

Earnshaw

[General Manager, Carbon Limestone Co.,
Youngstown, Ohio]

likes Marions

High production is the thing which distinguishes Marion Shovels everywhere. F. O. Earnshaw, whose picture is shown at the right, is working nine of them. He says:

"Our new Model 76 with its crawler trucks has been working a face of stone less than five feet thick and repeatedly has loaded over 2100 tons of stone in a nine-hour day. The year 1925, just ended, 2 of our Model 76 Marions mounted on crawler trucks working against a 20-ft. face have dug and loaded the grand total of 950,000 tons of stone. This was accomplished on a six 10-hour day per week schedule. It goes without saying that we are more than satisfied with such performance. We are strong for crawlers"



Marion

Power Shovels

Electric·Steam·Gasoline·Electric

C O M E T O S H O V E L H E A D Q U A R T E R S

Made in standard sizes from $\frac{3}{4}$ -yd to 8-yd., revolving and railroad types. Fitted with crawlers, railroad trucks or traction wheels as desired. Revolving shovels are convertible for crane or dragline operation. Immediate delivery on all standard units.

THE MARION STEAM SHOVEL CO.

Established 1884

MARION, OHIO, U. S. A.



G.L.I.



It Digs In For Profit

The Modern Massillon takes in-built power, speed and a capacity for steady, profitable work to the job.

It is dependable too, adaptable to the hardest digging problem, simple in construction and economical in operation. It digs for profit.

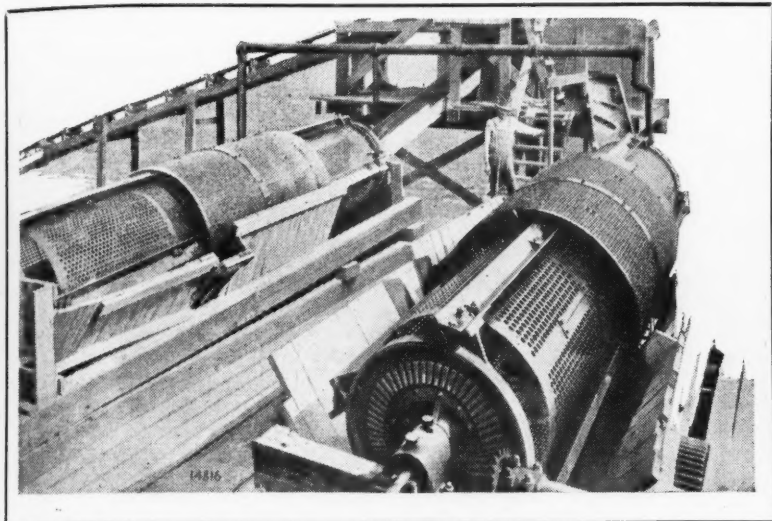
THE RUSSELL & CO.

B U I L D E R S

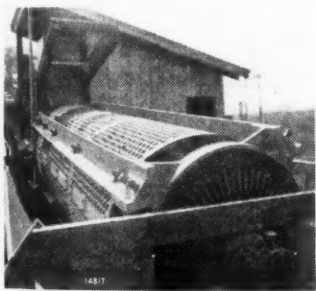
MASSILLON, OHIO

The **MODERN**  **MASSILLON**
 Steam —  — Shovel

For Efficient Washing and Separating Use Jeffrey Improved Revolving Screens



Showing two 48" Jeffrey Revolving Screens for washing and screening sand and gravel at the plant of the Jackson Pike Sand and Gravel Co., Columbus, Ohio.



Scalper screen at the above plant. Parts interchangeable with washing screens.

Some Special Features:

Large scrubbing sections with high pressure spray pipes entering screen at both ends.

Easily changed screen plates.

Substantial end castings.

Lower end bearing adjustment and mounted integral with countershaft.

Large trunnion rollers and bearings.

Separate renewable drive parts.

Let Experienced Jeffrey Engineers make a complete plant investigation of your Elevating, Conveying, Crushing and Screening Requirements. Write us fully about your local conditions.

The Jeffrey Mfg. Co., 917-99 North Fourth Street

Columbus, Ohio

JEFFREY

MATERIAL HANDLING EQUIPMENT

50 Tons in 30 Minutes



THIS No. 2 crane with a $\frac{3}{4}$ -yard Excavator bucket unloaded 50 tons of crushed stone from car to bin in 30 minutes. The Union Paving Co., Pine Grove, Pa. reports average of ten 50-ton cars of crushed stone handled daily.

This outfit—No. 2 crane and Excavator bucket—is hard to beat for tough digging or fast rehandling. May we send you complete details?

Locomotive Cranes • Pile Drivers • Car Dumpers • Clam-shell Buckets • Derrick Cars

C-2-H

McMyler-Interstate

NEW YORK PHILADELPHIA CLEVELAND DETROIT SAN FRANCISCO
BUFFALO PITTSBURGH CHICAGO LOS ANGELES



The Orton Model "V" 1-2 Yard Gas Shovel is an ideal machine for use in the small sand or gravel pit—fast and economical

300 to 400 yards of material a day

The Model "V" Gas Shovel is just the machine for the small sand and gravel pit where the daily output does not warrant the purchase of a large steam shovel.

This machine is powered by a 53 H. P. Hercules Gasoline Motor which is economical on gas and oil. Traveling, steering, hoisting, crowding and dumping are executed by one man from the cab.

The Model "V" is equipped

with a boom that measures 16'-0" from pin to tip. The dipper stick is 12'-6" long—not including the $\frac{1}{2}$ yard scoop. It has a maximum reach of 24' from boom pin to dipper scoop; a maximum dumping height of 14' from the ground.

The "V" is mounted on the famous ORTON Flexible Treads. It is easily and quickly converted into a 5-ton Clamshell Crane, Ditcher or Skimmer Scoop or Dragline in the field.

Write for specifications and prices

ORTON CRANE & SHOVEL CO.

Formerly ORTON & STEINBRENNER CO.

Locomotive Cranes,
Flexible Tread
Cranes, Gantry
Cranes, Truck Cranes.

608 So. Dearborn Street
CHICAGO, ILL.

Clamshell Buckets,
Orange Peel Buckets,
Rock Crushers, Power
Shovels.

A Shovel or Crane Is No Stronger Than Its Cables!

When you buy a Shovel or Crane, it usually comes to you equipped with Wire Rope.

Make this test:—Please! Ask the manufacturer what grade (tensile strength) of wire rope he has put on. When he tells you, ask him to prove it. You're entitled to this—it's the life of your workmen you're risking.

The good reputation and the "say so" of any manufacturer *doesn't—mean—a—thing* when you are asked to risk your life. You're entitled to **KNOW** what you are using—A *live* man is worth more than all the dead ones.

WILLIAMSPORT Telfax Tape Marked—Factory Certified WIRE ROPE

proves its grade in plain English—anyone can see it plainly—it is indestructible and this protection is worth more to a user than the wire rope costs. The best insurance you can buy.

Manufacturers who equip with Williamsport Wire Rope deserve your confidence. They want you to know what you are getting.

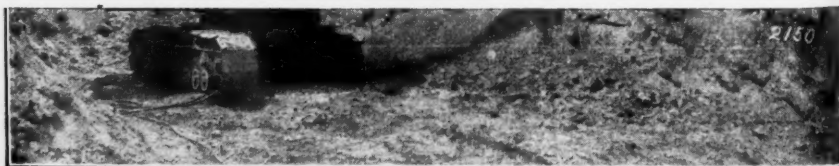
The McMyler Interstate Co., is one of these manufacturers. There are others. Write us for their names.

Williamsport Wire Rope Company

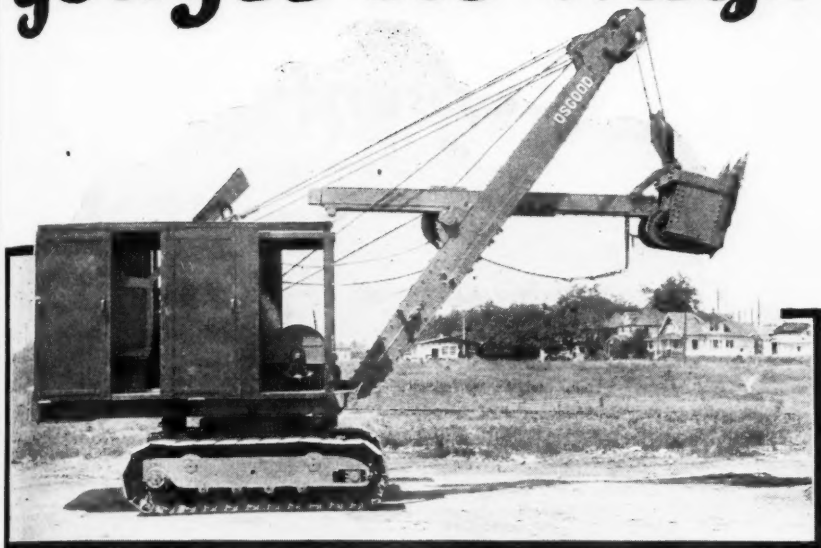
General Sales Office—Peoples Gas Bldg., Chicago
Main Office and Works—Williamsport, Pa.



USE MADESCO TACKLE BLOCKS—THEY STAND THE GAFF



gouges it's way!

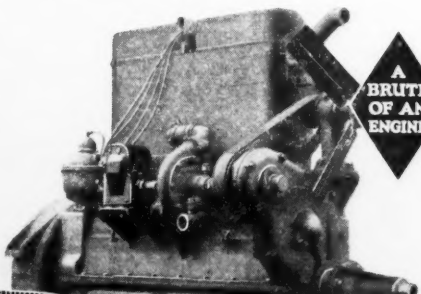


Beaver Power Is Back of the Bite.!

Heavily packed ground, rock and other rough digging is everyday duty for Osgood Power Shovels. There's no choosing of work. Every job presents difficult conditions and every Osgood is equal to the work.

From the crawler tracks to the dipper teeth—Beaver power gives "action" to every move. See the Osgood in operation and you will have a new understanding of smoothness, and flexibility which are characteristic of Beaver power. Much of the success of the Beaver is due to freedom from vibration.

Compare the Beaver powered Osgood with any other power shovel and you will agree that such balanced smoothness and easy turning effort, Beaver advantages, mean more yards and more years.



A
BRUTE
OF AN
ENGINE

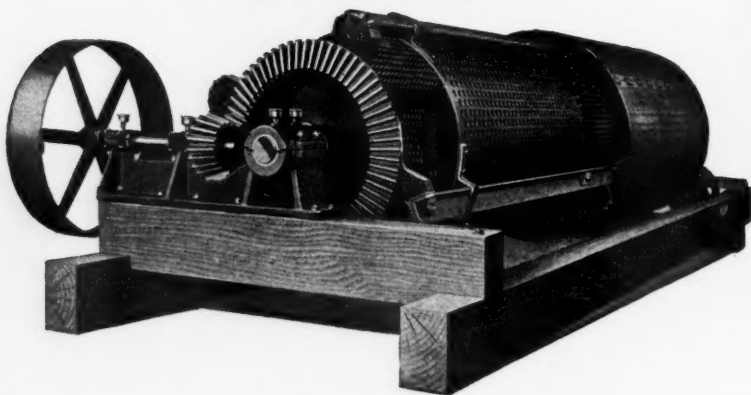
Beaver Mfg. Co.

35—25th St., Milwaukee, Wis.

The Beaver Engine is made in sizes ranging from 25 to 150 H.P. Let us prove our points of brute strength power. Write for circulars describing Beaver Industrial Engines in detail.

FOR STEADY SERVICE
Beaver

A Highly Satisfactory Screen!



Experienced Operators Say

Toepfer Screens give accurate, uniform grading of materials in standard sizes, and constant, consistent performance. This is why they satisfy users.

The Toepfer Combination Screen and scrubber washes and classifies products and delivers as many sizes as our regular screen without requiring additional space.

Let us send you full information and literature

TOEPFER

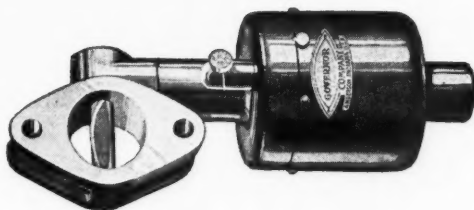
REVOLVING SCREENS

W. TOEPFER & SONS CO.

Broadway and Menominee St.

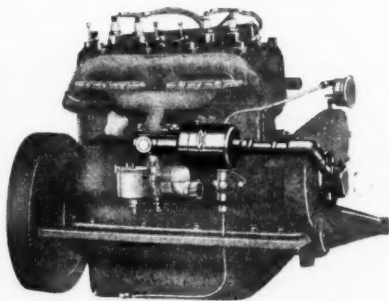
MILWAUKEE, WIS.

Ungoverned Power Destroys Machine Efficiency



Pierce governors can be applied to most of the standard engines manufactured by the large engine manufacturers.

The Pierce governor is the most compact and ruggedly built centrifugal governor on the market. Simple in construction, its operation is always positive.



Any gasoline power unit used in the pit, quarry, or mill, can be more economically and efficiently operated by incorporating a Pierce governor, whether it is an air compressor, locomotive, hoist, pump, or conveyor.

Write for Booklet No. 55

The Pierce Governor Co.

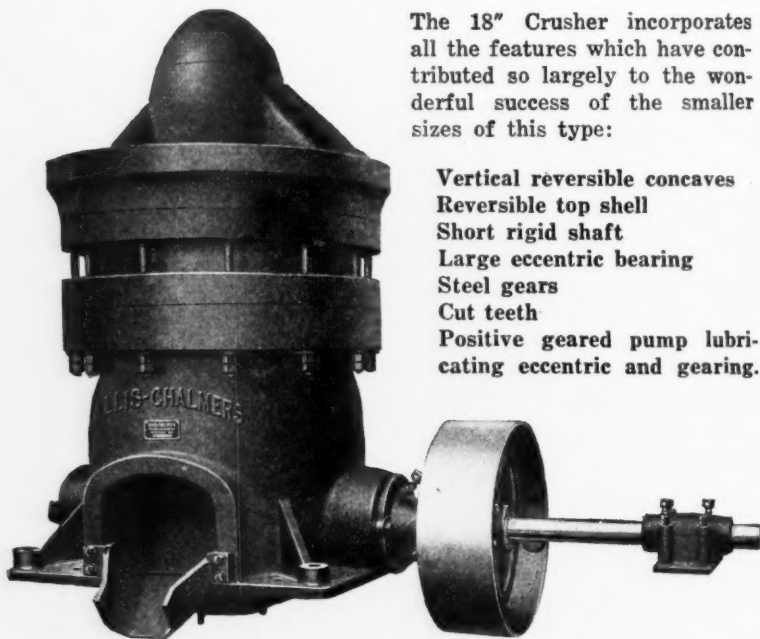
"World's Largest Governor Builders"

Anderson

Indiana

New 18 Inch Superior McCully Fine Reduction Gyratory Crusher

The latest development in the Superior McCully Fine Reduction line, furnished to a large Cement Company—Having two feed openings each 18" by 68"—Capable of taking the product from the largest size primary crushers—Capacity with minimum discharge opening of $2\frac{1}{2}$ "—225 to 275 tons per hour.

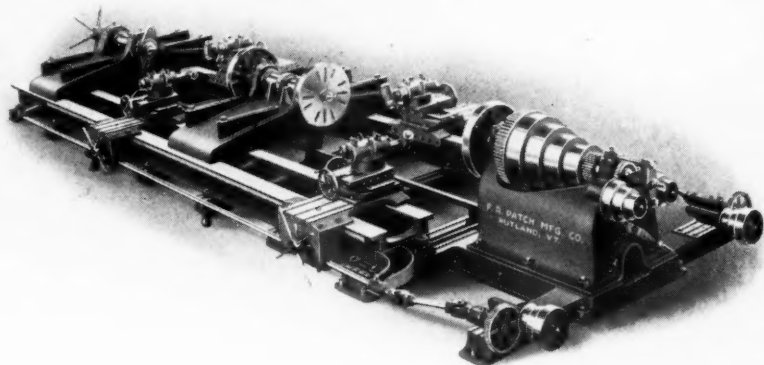


The 18" Crusher incorporates all the features which have contributed so largely to the wonderful success of the smaller sizes of this type:

- Vertical reversible concaves
- Reversible top shell
- Short rigid shaft
- Large eccentric bearing
- Steel gears
- Cut teeth
- Positive geared pump lubricating eccentric and gearing.

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.



Heavy Design Four Tool Granite Turning Lathe with centerstock for turning two drum sections at the same time. Length over all 47' 2". Weight 122,000 lbs.

Finishing Machinery for the
GRANITE PLANT.
Gang Saws, Carbor-
undum Machines,
Lathes, Polishers.

Some Plants Where Above Design of Lathe is Operating:

Woodbury Granite Co., Bethel, Vt.

John Clark Co., Rockville, Minn.

Raymond Granite Co., Raymond, Cal.

Maine and New Hampshire Granite Corp., Redstone, N. H.

F. R. PATCH MFG. CO.
RUTLAND, VERMONT



The best conveyor carrier is none too good for the progressive gravel plant.

IT is just like anything else mechanical—those devices which are superior in quality and cost more initially, are generally the easiest to maintain and the last to depreciate. Equip your belt conveyors with Sacon Carriers.

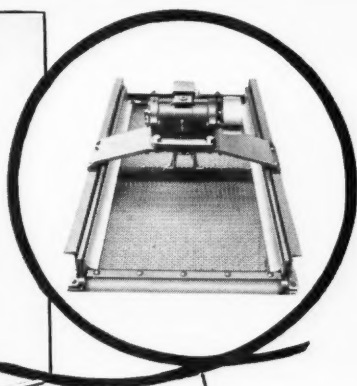
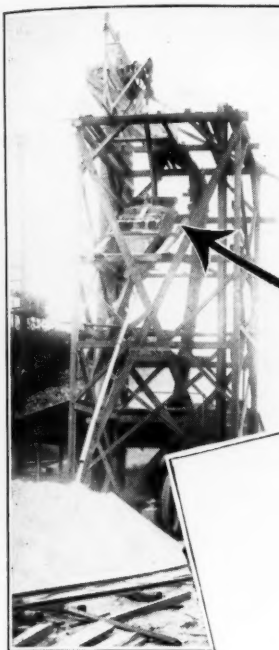
Write for description of this outstanding carrier.

STEPHENS-ADAMSON MFG. CO., Aurora, Illinois

Pacific Factory:
Los Angeles

Branches in
Principal Cities





HODGSON-KING SILICA CO.
NETCONG. IN. 2

January 9, 1926.

Pitt and Quarry
628 S. Clark Street
Chicago, Ill.

Gentlemen:

We purchased a Leaky No-Blind Vibrating Screen several months ago for the purpose of screening crushed silica and have found it perfectly satisfactory in every way. Previous to that time we used a shaker screen which quickly blinded and consequently slowed up production. Since installing the Leaky screen, we have eliminated this trouble and could ask for nothing better.

We have had to make no repairs, and the only cost of maintenance has been oil for the cam case. It produces sand, and if we have to enlarge our plant, we will undoubtedly install Leaky screens.

We recommend the Leaky No-Blind Vibrating Screen to anyone interested in screening problems.

Yours very truly,

HODGSON-KING SILICA CO.

Wm. H. King
Manager.

Constant Screening Without One Let-up

Write for Bulletin 12A

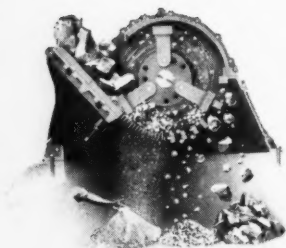
THE DEISTER CONCENTRATOR COMPANY

635 High Street
FORT WAYNE, INDIANA

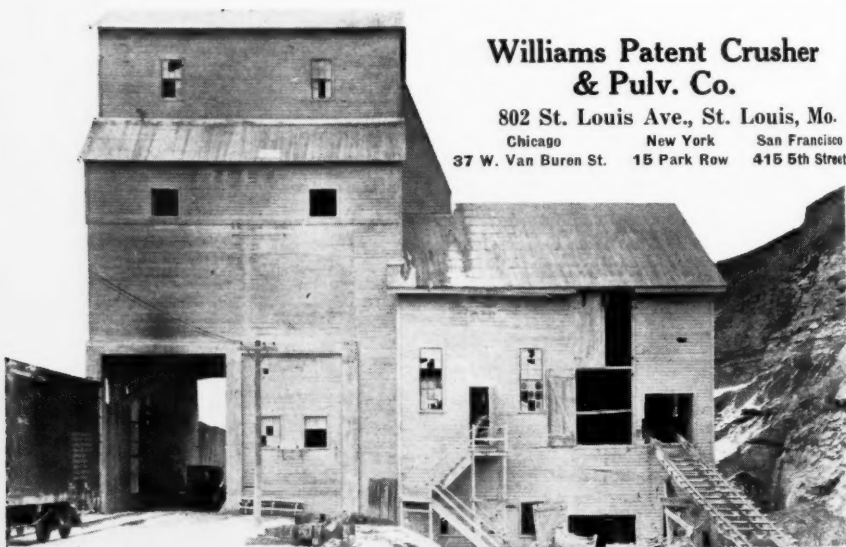
New York Office:
60 Water St.

"Operating Fourth Williams Crusher purchased since 1911. Makes Macadam with Less Fines than former types used"

*Southern Illinois Penitentiary
Menard, Ill.*



15 years is ample time in which to discover the defects of a crusher, and the purchase of their fourth Williams speaks for itself. Besides long life it must be remembered the Williams handles larger rock than any other type, one usually taking the place of two of any other type. First cost is 50% to 75% less, operating expense 35% to 53% lower and size control is more accurate, the same machine making clean macadam or agstone depending upon adjustment. Built in three types, the "Jumbo Junior" reduces one-man size rock to 1 1/4" agstone, the "Jumbo" 24-inch rock to 1 1/4" and the "Mammoth" 48" to 1 1/4"



Williams Patent Crusher & Pulv. Co.

802 St. Louis Ave., St. Louis, Mo.

Chicago New York San Francisco
37 W. Van Buren St. 15 Park Row 415 5th Street



ORIGINAL PATENTEES AND WORLD'S LARGEST BUILDERS OF HAMMERMILLS

WILLIAMS
PATENT CRUSHERS GRINDERS SHREDDERS

Hayward Buckets

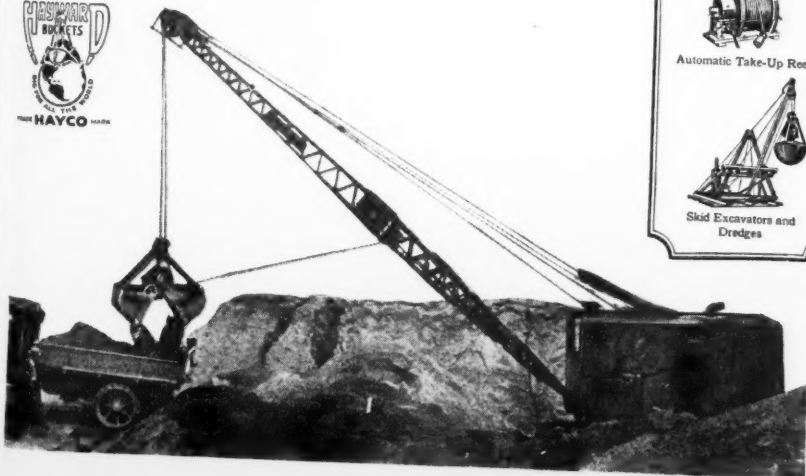
Testing Merit by Performance

Watch a Hayward at work—it's a revelation in efficiency to those who have not known how good a bucket can be when rightly designed and properly built.

Haywards have set the pace for nearly half a century—ever since the use of automatic buckets became an important factor in digging and rehandling bulk materials. Ever improved to meet the need for greater loads and faster operation, Hayward Buckets are today the recognized standards of comparison throughout the world.

Judge a bucket by the way it works—let service records be your guide in your choice of a bucket. Let us tell you more about Haywards and why they meet every test.

THE HAYWARD COMPANY
54-56 Church St., New York, N. Y.



Electric Motor Buckets



Clam Shell Buckets



Orange Peel Buckets



Drag Scraper Buckets



Counterweight Drums



Automatic Take-Up Reels



Skid Excavators and Dredges

THE CRUSHERS

with the
Troubles Left Out

WHY THEY LEAD

- 1—They are noiseless and run like watches.
- 2—50% greater capacity for same power.
- 3—Practically no wear on anything but head and concaves.
- 4—Short shaft and saving in head room with packed dust collars.
- 5—Shaft reinforced with self-locking head so that it cannot break where 90% of shafts have broken.
- 6—Can be driven right, left, or standard, as sent from shop.
- 7—Eccentric is turned by flexible coupling attached to pulley, which prevents side thrust and heating, as in geared crushers.
- 8—Ball and socket eccentric, self-aligning, eliminating friction and heating. Runs for years without attention.
- 9—Positive circulating oil system through filter and cut geared oil pump.
- 10—Made in our own shop by experts, trained for the job.
- 11—It is a crusher with the trouble left out. See it in operation, and you are unfit to listen to any geared crusher salesman. In fact, if you are near one of his machines, you can't hear him, if you are so inclined.
- 12—Our fine crusher does the work of 4 geared crushers.

Send for catalogue and tell us what your problems are, and one of our experts will call on you without obligation on your part.

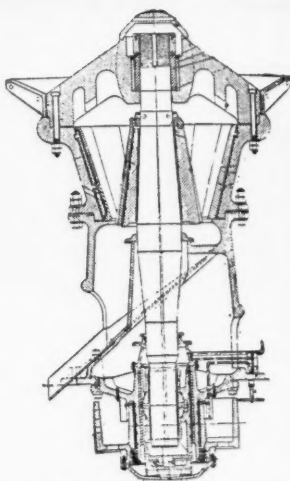
KENNEDY VAN SAUN MFG. & ENGR. CORP.

50 Church St.

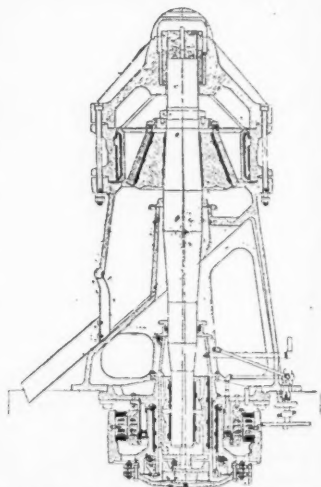
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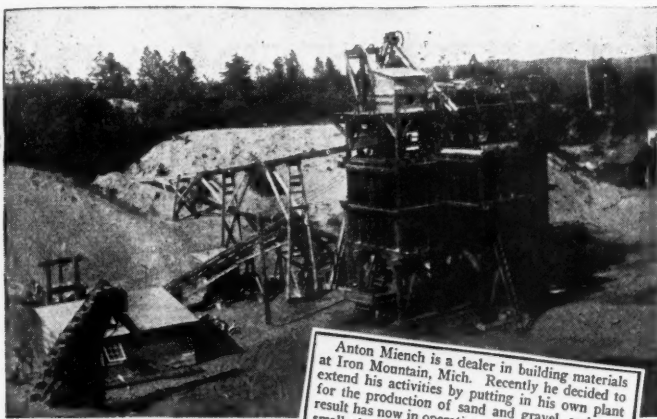
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Standard Ball Bearing Gearless Crusher.
Sizes No. 1 to No. 60—Weights 1,000
to 900,000 lbs.



Gearless Crusher for Fine Crushing.
Do not be deceived by Vertical Concaves; that is not what makes a fine crusher.



Anton Miench is a dealer in building materials at Iron Mountain, Mich. Recently he decided to extend his activities by putting in his own plant for the production of sand and gravel, and as a result has now in operation a compact and efficient small plant capable of turning out up to 250 yds. per 10-hour day.

The plant is located at Twin Falls, about 4 miles from Iron Mountain, and is producing five grades of material: plastering sand, brick sand, $\frac{1}{4}$ in. and under, and $\frac{1}{2}$ in. and over. A loader is also installed so that pit-run material can be loaded if there is demand for it.

The plant was designed for Mr. Miench by the Smith Engineering Works of Milwaukee. It in-

from
**"Cement, Mill
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 December 5, 1925

Mr. Miench left it to Tel-smith

Tel-smith engineers not only designed his plant, but built the machinery—from crusher to bin gates—and guaranteed it to suit his individual requirements. Expert service and centralized responsibility are the factors that characterize Tel-smith Balanced Service.

Mr. Miench's equipment was arranged to suit his conditions. The gravel is dumped into a concrete hopper, equipped with a 16 in. by 5 ft. Tel-smith Plate Feeder which regulates the flow of aggregate to the belt conveyor. The 18 in. Tel-smith Belt Conveyor discharges to a 24 in. Tel-smith Rotary Grizzly, which takes out the finer material so that only the coarse rock goes into the crusher, a No. 6A Tel-smith

Primary Breaker. Both crusher product and natural gravel pass into a No. 5 Tel-smith Belt Bucket Elevator, which feeds into a 32 in. x 14 ft. Tel-smith Washing Screen. This device not only scrubs but also sizes the material. The sand then goes to two Tel-smith Sand Tanks, which grade it into plaster and torpedo sand.

When *you* want a gravel plant—leave it to Tel-smith. Get a tailor-made plant to fit your needs—designed, built and guaranteed entirely by Tel-smith, a concern of pioneer experience and ample financial responsibility. Tel-smith means results—results mean profits for you. Glad to mail you Bulletin GP-15.

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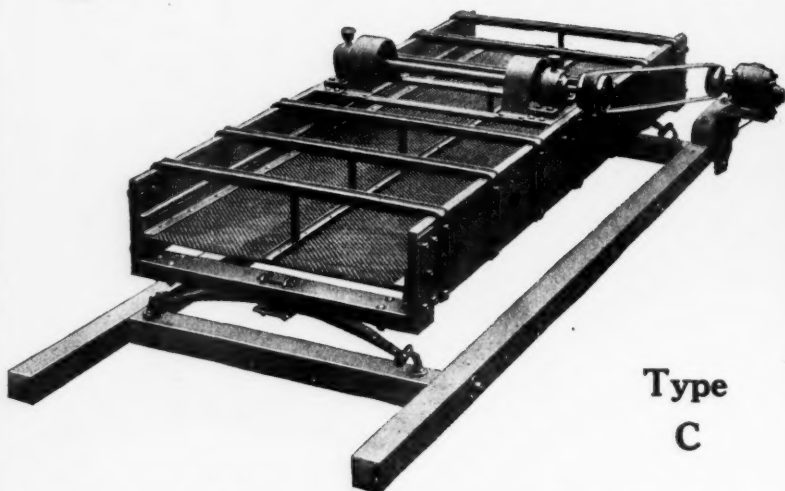
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G. P. No. 2

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Leading the Field—

FIVE years ago the first UNIVERSALS were placed on the market and introduced to Producers of Mineral Aggregate—the First Successful Mechanical Vibrating Screens.

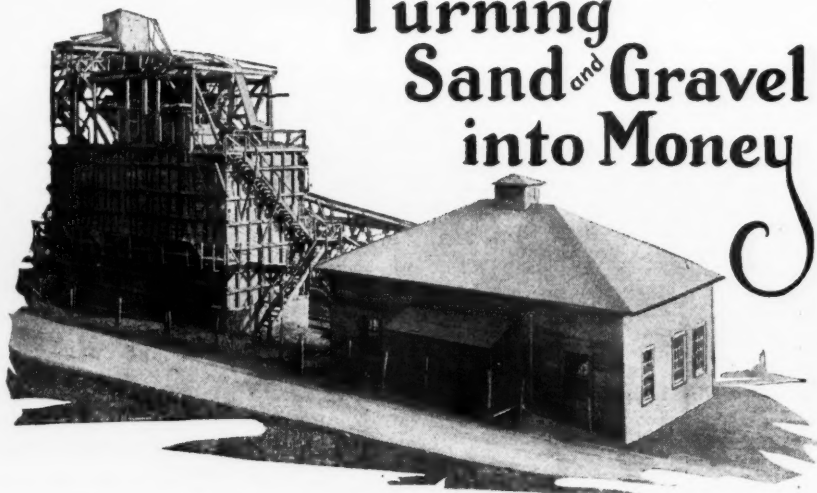
TODAY—they are leading the field—having won widespread popularity thru their superior performance. Producers of Stone and Gravel demand a thoroughly proven and tested screening unit, and know they are getting just that—when they place their orders for UNIVERSALS.

THE facts behind the better screening qualities of UNIVERSAL VIBRATING SCREENS are told in detail in our 24 page descriptive catalog No. 50. A copy is waiting your request.

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Send for our Sand and Gravel catalog 5-A which gives lots of useful information and also lists equipment most suitable for sand and gravel plants.

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LOOK into the success of many of the large sand and gravel plants in the United States and Canada. Good Road equipment—crushers, elevators, screens, conveyors—is responsible in a good number of cases. The reason for this is evident. Equipment that stands up under the most difficult working conditions and turns out sand and gravel speedily and at low cost is bound to produce big profits.

*Undivided responsibility enables us to install
sand and gravel plants that bring big returns*

From start to finish the responsibility rests on our shoulders. Our engineers go over the ground, check the material and lay out the plant. We do the building and equipping. In short, we carry the job all the way through in such a manner that means satisfaction and large profits for you.

The whole plant is planned and equipped on a systematic basis such as our experience along this line has proven most satisfactory. You can be assured of proper layout, of durable and efficient machinery, and of the backing of a reliable concern.

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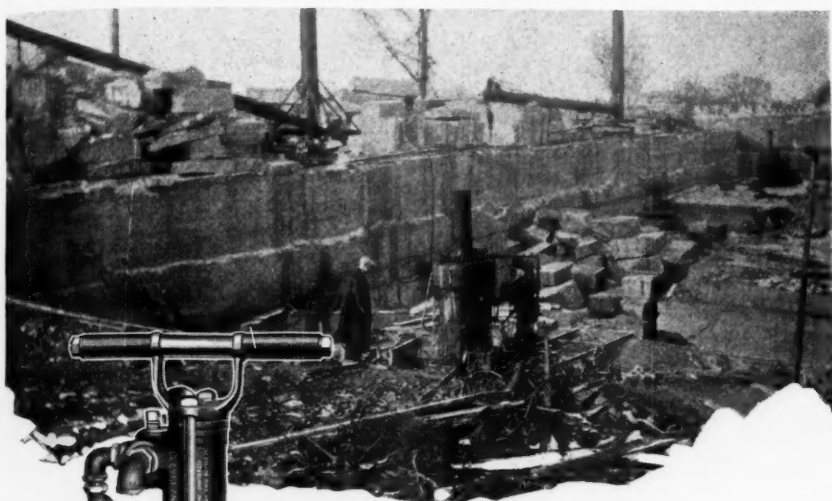
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At the quarry illustrated above, only steam drills are used, and Cleveland A1 Machines are doing their share in maintaining the low production costs for which the property is noted.

The A1 for Steam, Bulletin 53. The 44 for Air, Bulletin 49

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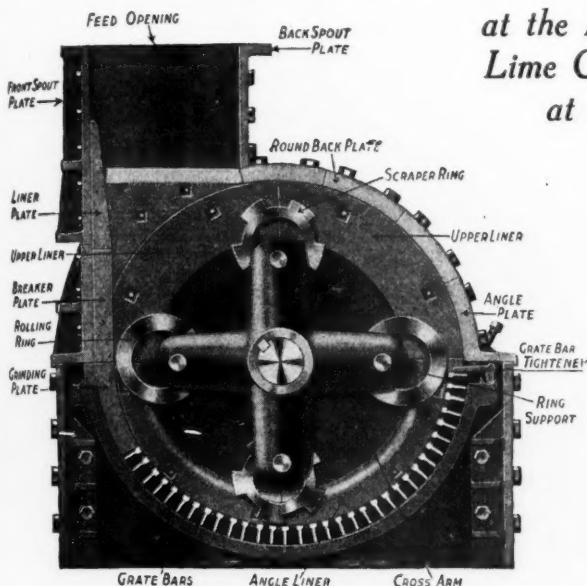
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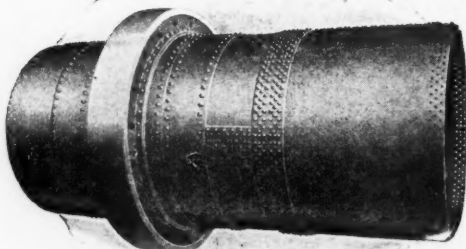
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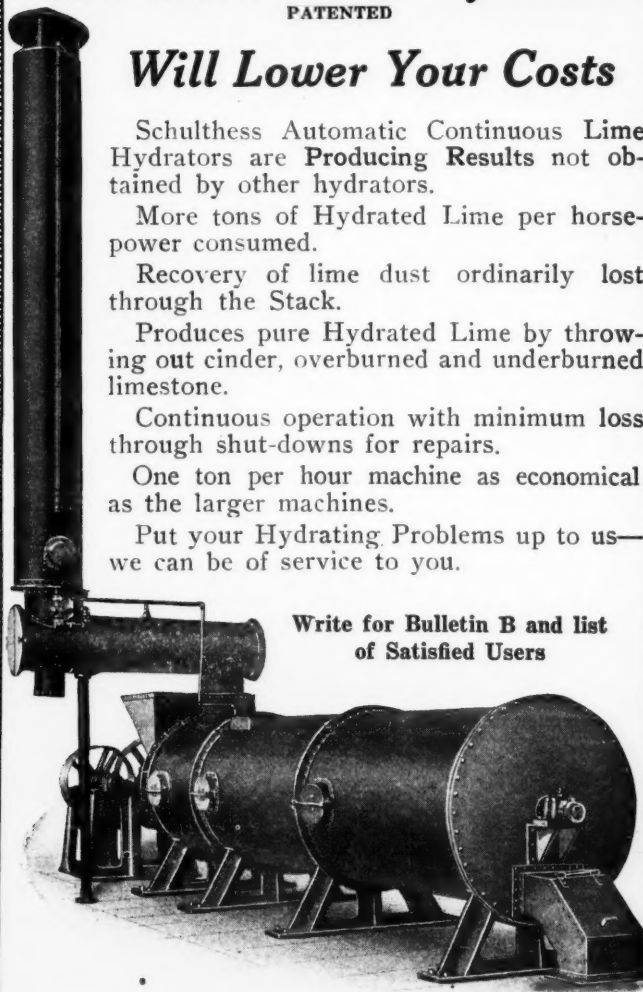
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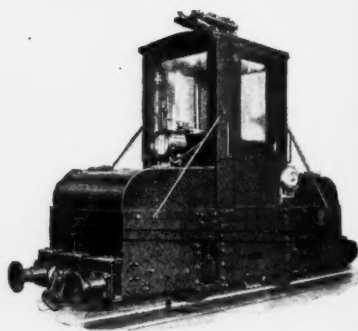
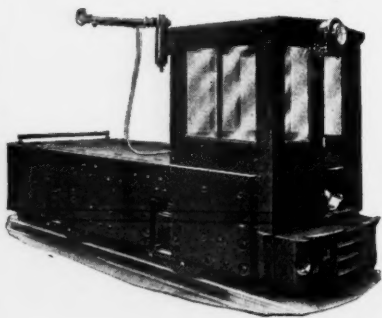
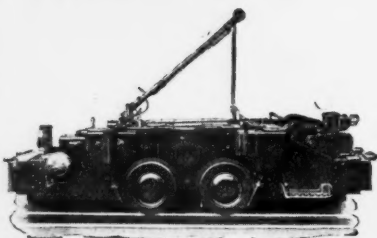
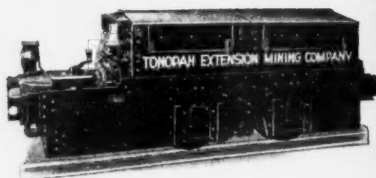
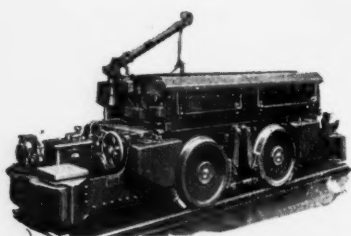
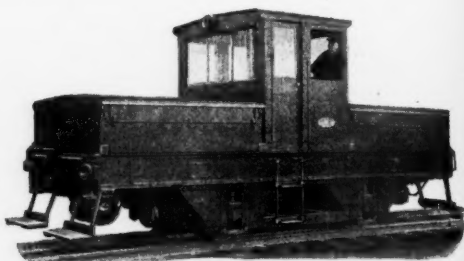
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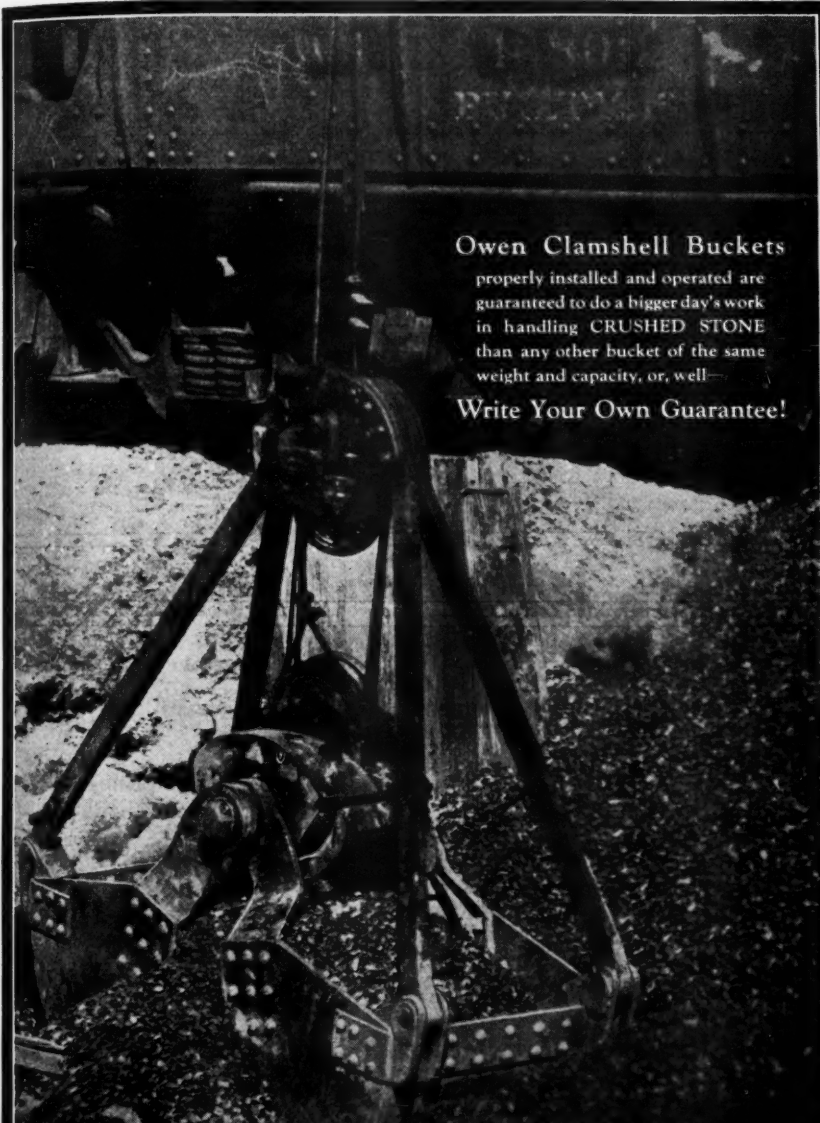
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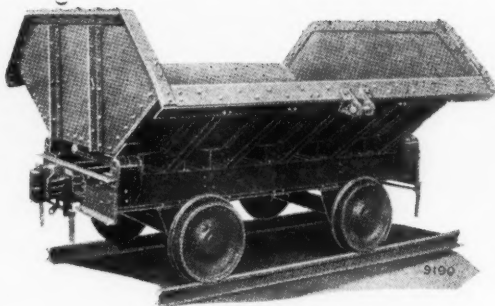
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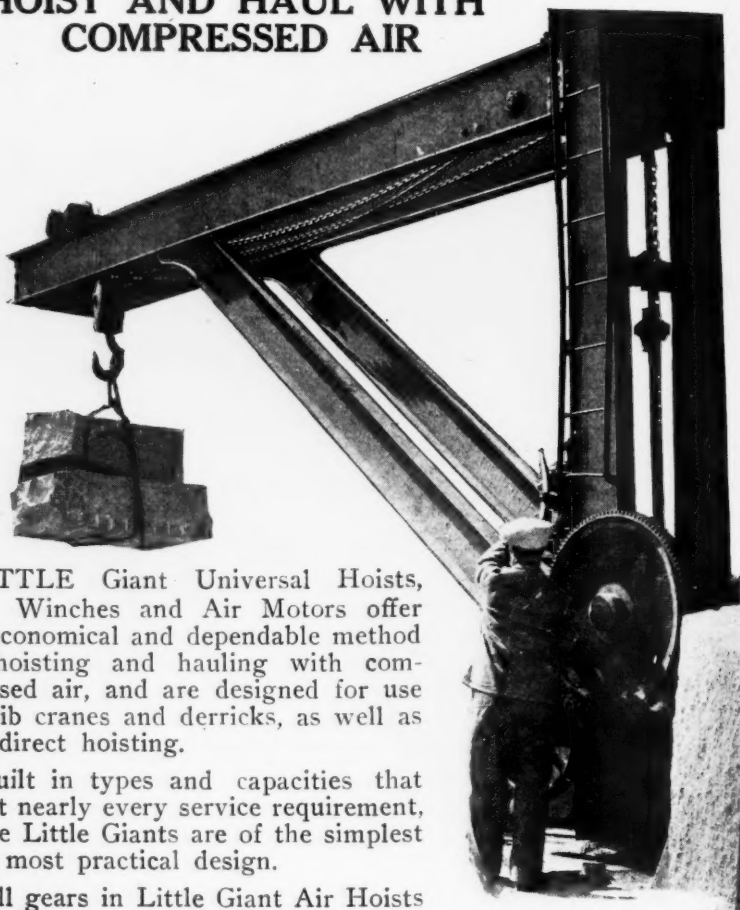
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This relieves the boom of the weight of the hoist itself and is more convenient for the operator.

P-224



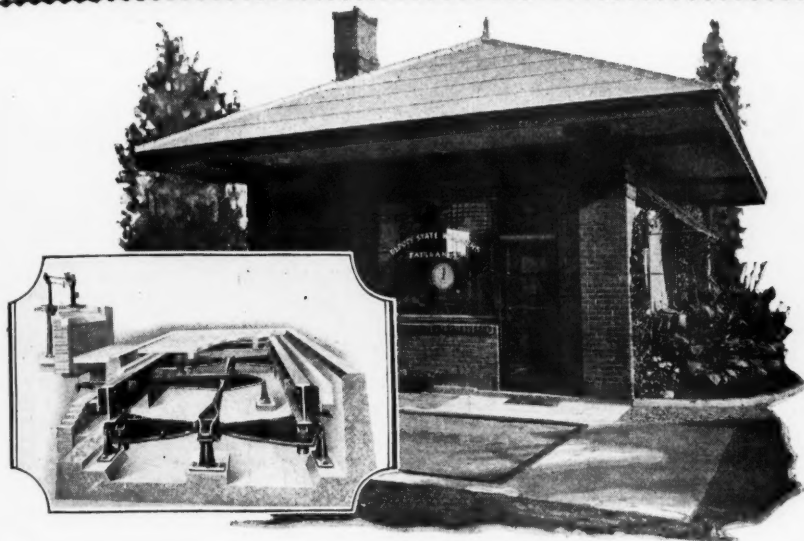
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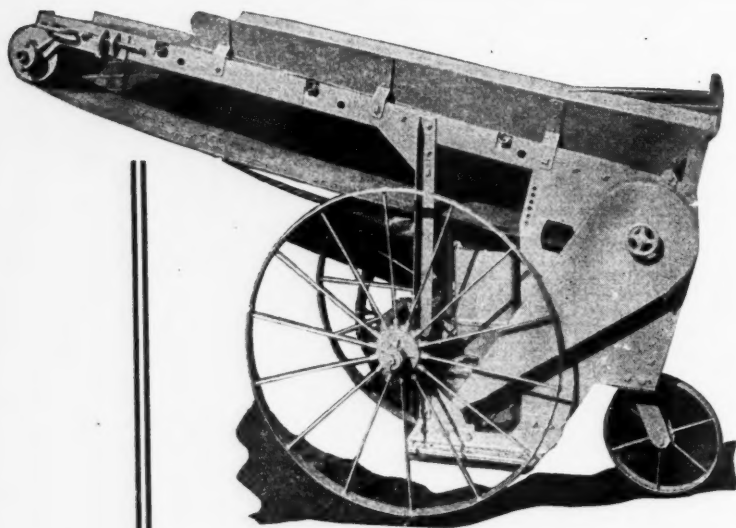
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| <input type="checkbox"/> Car Pullers | <input type="checkbox"/> Dragline, Scraper | |
| <input type="checkbox"/> Car Replacers | | |
| <input type="checkbox"/> Car Wheels | | |

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 Firm Name
 Address
 City State

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|--|--|--|
| <input type="checkbox"/> Gears | <input type="checkbox"/> Meters | <input type="checkbox"/> Screens, Perforated Metal |
| <input type="checkbox"/> Generators, Electric | <input type="checkbox"/> Mills, Chaser | <input type="checkbox"/> Screens, Rotary |
| <input type="checkbox"/> Governors | <input type="checkbox"/> Mills, Tube | <input type="checkbox"/> Screens, Vibrating |
| <input type="checkbox"/> Grapple, Stone | <input type="checkbox"/> Motors, Electric
(H. P.) | <input type="checkbox"/> Separators, Air |
| <input type="checkbox"/> Grate Bars | <input type="checkbox"/> Motors, Gasoline
(H. P.) | <input type="checkbox"/> Separators, Gypsum |
| <input type="checkbox"/> Grates | <input type="checkbox"/> Motors, Gasoline
Portable Power Unit
(H. P.) | <input type="checkbox"/> Separators, Magnetic |
| <input type="checkbox"/> Gypsum Separators | <input type="checkbox"/> Motor Truck Dump
Bodies | <input type="checkbox"/> Separators, Sand |
| <input type="checkbox"/> Hoisting Engines | <input type="checkbox"/> Motor Trucks | <input type="checkbox"/> Sheaves |
| <input type="checkbox"/> Hoists, Chain | <input type="checkbox"/> Nozzles, Hydraulic
Mining | <input type="checkbox"/> Shovels, Electric
(..... yd.) |
| <input type="checkbox"/> Hoists, Derrick | <input type="checkbox"/> Nozzles, Suction
Screen | <input type="checkbox"/> Shovels, Gasoline
(..... yd.) |
| <input type="checkbox"/> Hoists, Drum | <input type="checkbox"/> Oil Burners | <input type="checkbox"/> Shovels, Steam
(..... yd.) |
| <input type="checkbox"/> Hoists, Fordson | <input type="checkbox"/> Oils and Lubricants | <input type="checkbox"/> Speed Reducers |
| <input type="checkbox"/> Hoists, Hydraulic,
Motor Truck | <input type="checkbox"/> Perforated Metal | <input type="checkbox"/> Steel Barrels |
| <input type="checkbox"/> Hoists, Hand, Motor
Truck | <input type="checkbox"/> Picks and Shovels | <input type="checkbox"/> Steel, Drill |
| <input type="checkbox"/> Hose, Sand Suction | <input type="checkbox"/> Pipe, Hydraulic | <input type="checkbox"/> Steel, High Speed |
| <input type="checkbox"/> Hydrators | <input type="checkbox"/> Pipe, Iron | <input type="checkbox"/> Steel, Manganese |
| <input type="checkbox"/> Hydraulic Mining
Nozzles | <input type="checkbox"/> Pipe, Spiral | <input type="checkbox"/> Steel, Structural |
| <input type="checkbox"/> Hydraulic Pipe | <input type="checkbox"/> Plows | <input type="checkbox"/> Steel, Tool |
| <input type="checkbox"/> Hydraulic Pumping
Engines | <input type="checkbox"/> Powder, Blasting | <input type="checkbox"/> Stokers, Automatic |
| <input type="checkbox"/> Hydraulic Valves
(Pulpit and Indi-
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Steel | <input type="checkbox"/> Stone Grapple |
| <input type="checkbox"/> Idlers, Belt Conveyor | <input type="checkbox"/> Power Transmitting
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ment, Power |
| <input type="checkbox"/> Industrial Railway
Systems | <input type="checkbox"/> Power Unit Gasoline,
Portabale
(H. P.) | <input type="checkbox"/> Superheaters |
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| <input type="checkbox"/> Loaders, Boom and
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| <input type="checkbox"/> Locomotives, Steam
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| <input type="checkbox"/> Log Washers | <input type="checkbox"/> Rope, Wire | <input type="checkbox"/> Transformers,
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| <input type="checkbox"/> Lubricators | <input type="checkbox"/> Sand-Lime Brick
Machinery | <input type="checkbox"/> Trolley Carriers |
| <input type="checkbox"/> Magnetic Separators | <input type="checkbox"/> Scales, Automatic,
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Parts | <input type="checkbox"/> Scrapers, Power | <input type="checkbox"/> Turbines |
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| <input type="checkbox"/> Metal, Perforated | <input type="checkbox"/> Screening Equipment | <input type="checkbox"/> Unloaders, Boom
and Bucket |
| | (See other side) | <input type="checkbox"/> Unloaders, Conveyor |
| | | <input type="checkbox"/> Wagons, Dump |
| | | <input type="checkbox"/> Washers, Log |
| | | <input type="checkbox"/> Washing Equipment |
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| | | <input type="checkbox"/> Winches |
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To be used for.....

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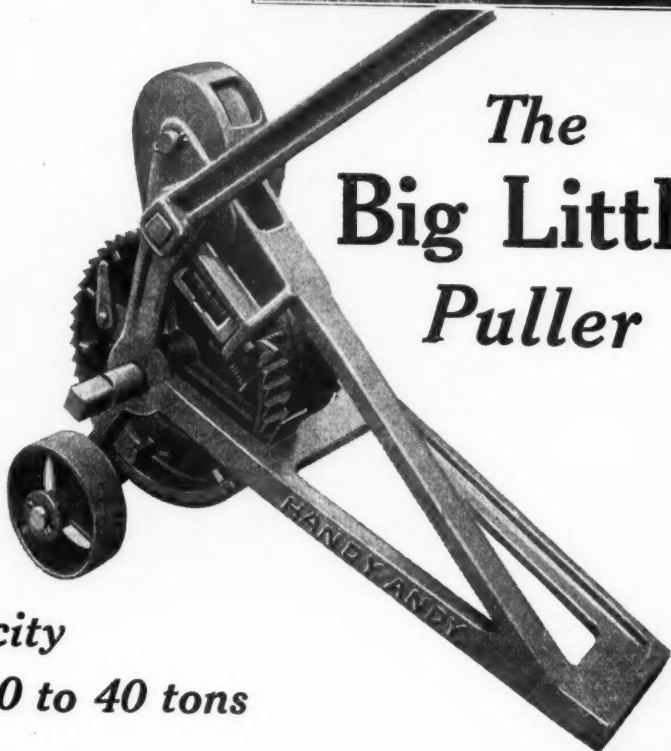
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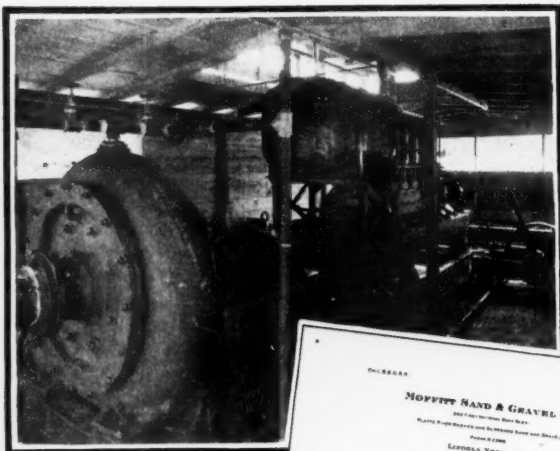
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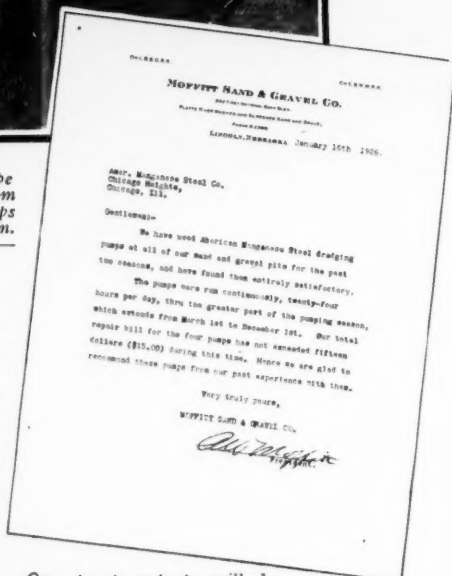
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A Semi-Monthly Publication for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metallic Minerals.

Subscription price \$5.00 per year. Single copies 25c.

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Pit *and* Quarry

Vol. 11

Chicago, Ill., March 1, 1926

No. 11

Industrial Pensions

WHENEVER an improved condition for the employer or for the employe is obviously beneficial to both, it is certain to be satisfactory and permanent. If the change benefits the employer only, it probably results in a feeling of bitterness and unrest among the workers; if it benefits the men only, it appears in the light of charity—always undesirable. The fundamental reason for the growth and success of all plans for industrial pensions is that the ultimate purpose is the improvement of industrial relations. If benevolence alone were the underlying motive, the expenditures would not be justified. Practically all plans, however, secure length of service by assuring financial security in old age as a reward for long and continued service. A typical clause reads, "These plans will be considered as a participation in the profits of the corporation, rewarding employes for the increased value of their services which result from continuous employment and from cooperative effort." Such a statement places the pension in the class of something earned and has a wholesome effect on the employe.

Reducing turnover and increasing efficiency are not the only results of pensions which benefit the employer. They may function also as a preventive in the case of unrest and strikes. One pension arrangement includes the clause, "Pensions are granted as a reward for loyal and faithful service. No man can hope for nor should expect one, except in recognition of an

unbroken record of such service." A well devised pension plan provides a satisfactory method of providing for those whose old age renders their service inadequate and thus makes possible promotions of younger workers. Such benefits to the employers do not, of course, immediately justify the costs involved but will eventually result in improved quality of the product, increased production, and more harmonious labor conditions. At present employers disagree regarding results beneficial to themselves. The plans in many cases are not at fault but are not effected with wisdom and discretion.

It will require time and thought together with a study of human nature to perfect the situation. The attitude of the employes is an important factor in securing a successful plan. Unless it wins their respect and confidence, there can be no results that will justify the expenditure. Their chief interest is in current wages rather than in future pension allowance. This is especially the case with the younger men who are optimistic regarding the future. Unless the plan provides an adequate allowance, and security for the plan, it will not interest either the younger or the older men. There is the possibility that the plan may appear in the light of paternalism which is regarded with hostility by labor unions.

Most plans fall under three general types; informal, formal discretionary and limited contractual. The principal differences are the financing, by the employer alone or jointly with the employe, and the employer's rights and liabilities, whether limited by obligations or subject to his discretions. Under the informal plan aged workers

are given light routine work or are pensioned at the discretion of the management and men.

In larger organizations the formal type of pension plan is more suitable to conditions. Allowances are conditional upon the fulfillment of definite conditions by the employee rather than upon individual merit. Such plans are voluntary, subject to change or discontinuance at the will of the management thus leaving the employer independent and free from contractual liability. In some cases the pension plan is specified as entirely a gratuity. This is due to the fact that scientific figures have not been worked out and the employer cannot foresee what the aggregation of his obligations will be at the end of a specified period. Some pension plans are so arranged that they are dependent upon the earnings of the company.

The limited contractual plan guarantees an allowance to employees who are already drawing a pension and, in some cases, to those who will become eligible within a certain specified time. It reserves to the employer the right to exclude all other employees

from future participation in case the plan is discontinued. Fully contractual plans are found only in systems where employer and employee alike contribute to a fund administered by an insurance company. They make legal the employer's responsibility and liability for the payment of the pension allowance. The employer retains the right to reduce the amount of his contribution in case of a general reduction of wages since he pays a fixed proportion of the employees' salaries. This form does not presuppose a lifetime of service before pension benefits can be earned but rather guarantees that deferred pay earned in prosperous years will be paid later in so-called "lean" years.

Within the last fifteen years 201 of the 248 plans for industrial pensions have come into existence. These figures apply to those adopted in private, industrial, mercantile and financial organizations, exclusive of fraternal or governmental plans. A recent survey of industrial pensions by the National Industrial Conference Board furnishes interesting data on this subject.

The 1926 Pit and Quarry Hand Book

THE 1926 edition of Pit and Quarry Hand Book has now been distributed and judging from the few comments which we have received already, it is a success. This edition is so completely different from any of the others that it is in fact something new. The first difference readily noticed is the increased number of pages. The second difference is in the text and its arrangement. The book is divided into sections which have been prepared by individual specialists.

The purpose of this edition has been to present a reference volume of practical information for the design, operation and management of cement, lime, gypsum, crushed stone, sand and gravel, phosphate, silica, etc., plants. In developing this purpose an editorial staff of recognized ability was charged with the duty of preparing a hand book which would be a comprehensive source of practical and reliable information. Diligent effort has been made to select problems and to allot sufficient space for their presentation.

The book is divided into thirty sections. These sections include Drilling and Blasting, Accident Prevention by

R. N. Van Winkle; Crushing, Grinding and Pulverizing, Elevating and Conveying, Storing and Handling, Burning, Waste Heat Recovery by C. H. Sonntag; Stripping, Loading and Transporting, Dredging, Pumping, Hydraulic Stripping, Power Transmission by G. B. Massey; Power Plant Operation, Powdered Coal, by Charles Longenecker; Geology, Clinker Handling, by E. D. Roberts; Screening and Separating, Washing and Drying, Plant Design, by H. W. Munday; Hydration, by H. S. Owen; Lubrication, by F. A. Westbrook; Fire Prevention and Insurance, by Dwight Ingram; Cost Accounting, by D. J. Hutchinson; Shipping Data, by J. H. Donnel and other sections such as Statistics, Useful Data, etc.

Never before has such an elaborate and useful publication been given to the executives of the non-metallic mineral industries and the editor and his associates will appreciate the comments, criticisms and suggestions of all who receive this edition that they might know to some extent the value of the service rendered and any needs for the improvement of future editions.

—H. W. M.

Effect of Lime on Concrete Products

By Paul C. Cunnick*

Director of Laboratories, Rock Island Arsenal, Rock Island, Ill.

MANY authorities have concluded that the use of more than 10 per cent of lime in concrete was not warranted. It has been assumed that this was also the economical limit in the manufacture of concrete products, but no data could be found on the subject. Apparently no serious investigation has been made of the use of lime in this important branch of the concrete industry. The object of the following tests was to indicate the effect of lime on concrete products and this report covers about 1500 test operations to this end.

Acknowledgment is made to Herman Meier, of the Northwest Davenport Cement Block Works, Davenport, Iowa, and to Sidney P. Moore, president of the Builders' Materials Co., Cedar Rapids, Iowa, whose plants made the test units in their regular operations; and to Col. D. M. King, commanding officer, and John Robertson, of the laboratory, Rock Island Arsenal, where the tests were made. The investigation was sponsored by the National Lime Association and their representative, J. S. Elwell, collaborated throughout.

Outline of Investigations.

Block Plant Test No. 1.—The first units for this test were manufactured at the plant of the Northwest Davenport Cement Block Works, Davenport, Iowa. This run consisted of 36 variables, with 6 mixes and 6 lime contents and it totaled 250 test units. Crushing tests at the age of 7 and 28 days showed the strengths to be increasing at 20 per cent addition of lime, which was the maximum used. This made necessary another plant run to determine the point where the addition of lime would cause the strengths to fall off.

Block Plant Test No. 2.—The second field run was made of the concrete block plant of the Builders' Materials Co., Cedar Rapids, Iowa. Thirty-six variables—including both hydrated lime and quick-lime putty—were run for a total of 990 test specimens. These blocks were shipped to the Rock Island Arsenal for strength and absorption tests. Five units were

provided for the absorption and five for crushing at 28 days, 3 months, 6 months, 1 year and 2 years respectively, or 30 units of each kind. All tests except the 1 and 2-year strengths are now completed. In this test the strengths at 28 days and 3 months were so unusual that it seemed advisable to run some laboratory experiments in confirmation.

Laboratory Experiment No. 1.—Study of certain conditions and results of manufacture in these two commercial plants leads to a consideration of curing methods. A laboratory experiment was made at the Rock Island Arsenal in which 6 mixes and 6 curing methods were used for a total of 36 variables and 180 test specimens. Conditions paralleling in every possible way the Cedar Rapids run were used.

Results of this experiment based on 28-day strengths, indicate that steam curing may be eliminated by the use of lime, under certain conditions. Further study is planned.

Laboratory Experiment No. 2.—In order to confirm the results obtained in Plant Test No. 2 and Experiment No. 1 another laboratory experiment was made. This work paralleled the Cedar Rapids run in all respects; i. e., materials, mix and manufacture. All materials were obtained from the Cedar Rapids plant. Two curing methods, 3 mixes and 11 lime contents gave a total of 66 variables and 330 test specimens for this work.

All investigations made to date have been with the products made by the dry method. The plant and laboratory operations have closely followed the "Recommended Practice for the Manufacture of Concrete Products" of the American Concrete Institute. Crushing and absorption tests were made as approved by the same authority.

General Indications.

Briefly summed up the general indications of the results are:

1. Appearance of the product is improved by all percentages of lime.
2. Strength:

- (a) Up to 40 per cent by weight hydrated lime gives an average increase in

*A paper presented before the American Concrete Institute at its 22nd annual convention in Chicago, February 23-26, 1926.

strength of approximately 1 per cent for each pound of lime added per sack of cement.

- (b) Aged lime putty gives considerable increase in strength, also much quicker set than equivalent amounts of hydrate.

- (c) All percentages of lime tested show increase in strength from 28 days to 6 months of age.

3. Absorption:

- (a) Determined by the standard immersion method absorption increased uniformly from 6.2 per cent without lime to 7½ per cent with the maximum lime content used.

- (b) Determined by impounding water on one face, absorption is not increased by the use of lime.

4. Permeability as determined by impounding water on one face, is eliminated by use of 20 per cent or more of hydrated lime or equivalent in lime putty.

5. Penetration of Dampness into the product decreases as the lime is increased.

Details of Investigation.

Block Plant Test No. 1.—Several plants were considered for this preliminary investigation and the plant of the Northwest Davenport Cement Block Works was chosen as they were

operating along the lines of good practice. The test was run by the regular operatives and care was taken in the measurement of materials to insure uniformity and in recording conditions. Table 1-A gives the data of proportioning as recorded. Mixing in a Blystone mixer 1½ min. dry and 1½ min. wet was uniform in all cases. The blocks were cast in an Ideal horizontal core machine and cured in saturated air at 90 deg. F. for 48 hours and then put into open March storage. The consistency of the mix was as wet as the machine operator could reasonably handle and care was taken to insure uniformity in all operations of proportioning, mixing, casting and curing.

The blocks were tested for crushing strength at the ages of 7 and 28 days at the Rock Island Arsenal and the results are shown in Table 1-A.

Block Plant Test No. 2.—In order to vary the manufacturing conditions the specimens for the second block test were made at the plant of the Builders' Materials Co., Cedar Rapids, Iowa. The materials used were all carried in stock and operating conditions were in no way changed except that a batch measuring box was installed which permitted the accurate measurement of materials. The prompt and complete delivery of materials to the mixer permitted a mixing time of 6 min., 3 min. dry and 3 min. wet, without slowing up the operation of the plant. It might be noted that this

TABLE 1-A.—PROPORTIONING DATA AND TEST RESULTS BLOCK PLANT Test No. 1

Mix.	Cubic Feet Natural Materials.		Cubic Feet Dry and Rodded Materials.		Fineness Modulus of Mix	Total Water Content, Pounds	Blocks Per Sack of Cement
	Sand	Gravel	Sand	Gravel			
1:4	2.00	3.00	1.74	3.00	4.20	49	11.0
1:5	2.25	3.50	2.83	3.50	3.90	56	13.8
1:6	3.50	4.25	3.04	4.25	4.00	63	16.6
1:7	4.00	5.00	3.48	5.00	4.02	70	19.4
1:8	4.67	5.67	4.06	5.67	4.15	78	22.2
1:9	5.17	6.33	4.50	6.33	4.01	85	25.0

7-Day Compressive Strengths

Pounds per sq. in. of gross area.

Mix	No Lime	5%—5 lb.	10%—10 lb.	15%—15 lb.	20%—20 lb.	10%—22½ lb.
		Hydrate	Hydrate	Hydrate	Hydrate	Quicklime Putty
1:4	1232	1258	1490	1330	1450	1750
1:5	863	752	1040	1063	980	1110
1:6	615	480	555	659	752	885
1:7	430	632	553	581	728	664
1:8	409	450	449	530	436	640
1:9	314	343	439	427	456	...

28-Day Compressive Strengths

1:4	1473	1655	1805	1551	1430	2120
1:5	996	1034	1180	1245	1066	1245
1:6	943	775	945	1040	1204	1109
1:7	585	816	707	856	957	1007
1:8	575	853	622	774	710	837
1:9	426	440	515	610	570	...

NOTE.—All statements are the average of three crushing tests.

measuring box is still in use. The tests were run through by the usual operatives and considerable care was taken to insure that all batches were uniform and of the desired proportions. The consistency for each variable was as wet as could be properly handled, throughout the operation, without slump. To this end the judgment of the machine operator was of great assistance in fixing the amount of water required.

Table 1-B gives the properties of the aggregates, the details of proportioning and the total water contents. Mixing was done in a Blystone tilting mixer and this mix was conveyed automatically to the feed hopper of an Anchor automatic tamper. This machine is of the vertical stripper type and is equipped with a manually-

operated feed. In casting the amount of tamping was as uniform as the operator could obtain. Curing was in steam at 125 deg. F. for 36 hours, followed by sprinkling night and morning for 6 days, in open May storage.

When about 20 days old the specimens were shipped to the Rock Island Arsenal laboratory and there placed in covered storage until needed for test. Tests have been made as follows:

Crushing strengths at 28 days, 3 and 6 months. (See Table 3.)

Absorption by standard immersion method. (See Table 4, Column 4.)

Absorption on one face. (See Table 4, Column 5.)

Permeability Tests. (See Table 4, Column 6.)

TABLE 1-B.—PROPORTIONING DATA

Determined in Block Test No. 2 and used in all laboratory experiments.
Properties of Aggregates.

	Sand	Gravel
Wt. of 1 cu. ft. of material in the natural state....	96.9 lb.	104.2 lb.
Wt. of above material, dry and rodded.....	92.8 lb.	101.6 lb.
Volume of above material, dry and rodded.....	0.84 cu. ft.	0.94 cu. ft.
Wt. of 1 cu. ft. of material, dry and rodded.....	110 lb.	108 lb.
Bulking of ratio of wet to dry material.....	119%	106%
Water content per cu. ft. material in natural state..	4.1 lb.	2.6 lb.
Per cent of water by weight in natural state.....	4.2%	2.5%
Sieve analysis:		
Retained on a No. 4 sieve.....	2%	10%
8 sieve.....	11%	58%
16 sieve.....	38%	98%
30 sieve.....	74%	100%
48 sieve.....	94%	100%
100 sieve.....	99%	100%
Fineness modulus.....	3.18	4.66
Required percentage for fineness modulus of 3.80..	57½%	42½%

Details of Proportioning

Mix. Cement to dry, rodded aggregates....	1:6	1:7	1:8
When mixed the separate vol. shrink to....	85%	85%	85%
Sum. vol. sand and gravel before mix.....	7.05 cu. ft.	8.22 cu. ft.	9.42 cu. ft.
Required volumes—dry and rodded:			
Sand—57½% of sum of volumes.....	4.05 cu. ft.	4.72 cu. ft.	5.42 cu. ft.
Gravel—42½% of sum of volumes.....	2.99 cu. ft.	3.48 cu. ft.	4.01 cu. ft.
Required volumes—in natural state:			
Sand—119% of dry volume.....	4.82 cu. ft.	5.60 cu. ft.	6.45 cu. ft.
Gravel—106% of dry volume.....	3.18 cu. ft.	3.68 cu. ft.	4.25 cu. ft.
Field mix as used.....			
Sand	4.8 cu. ft.	5.6 cu. ft.	6.4 cu. ft.
Gravel	3.2 cu. ft.	3.6 cu. ft.	4.2 cu. ft.
Cement, one sack.....	94 lb.	94 lb.	94 lb.
Blocks per sack of cement calculated....	17.8	20.8	23.8

RECORD OF WATER CONTENT FOR A ONE SACK MIX

Water Added, Water in Aggregates and Water in Putty, Totalled in Pounds

Mix	Without Lime	All pet. of Hydrate	22½ lb.—10% Putty	45 lb.—20% Putty	67½ lb.—30% Putty	90 lb.—40% Putty	112½ lb.—50% Putty
1:6	80	80	84½	89	93½	94	102½
1:7	88	88	88½	95	101½	106	108½
1:8	105	105	109½	114	114½	115	119½

Penetration of Dampness into the unit. (See Table 4, Column 7.)

Laboratory Experiment No. 1.—In order to determine that lime-cement products were advantageously cured by the customary steam and moist methods, it was decided to make a curing experiment. Hydrate and putty equivalent to 20 per cent of hydrated lime were used in three mixes and five specimens of each of these six variables were cured under six different conditions. These data together with the 28-day strengths are in Table 5.

After consideration it was decided to investigate further two of these

curing methods: Twenty-four hours in steam at 125 deg. F. followed by 6 days sprinkling as compared with one week moist curing.

Laboratory Experiment No. 2.—To check from another angle, the results obtained in the above tests, a series of 2x4-in. cylinder specimens were made in the laboratory having the same variables and materials as used in the Cedar Rapids test. The mixing was done in a small mixer built after the manner of a standard Blystone and driven on the centers of an engine lathe. The specimens were made in a split core box of the proper dimensions. The materials were de-

TABLE 2.—EFFECT OF LIME ON 28-DAY COMPRESSIVE STRENGTH

Marked	Proportion of Cement to Aggregate	Lime added per Sack of Cement, pounds	Plant Test Number 2		Plant Test Number 1		Laboratory Experiment Steam Cured		Laboratory Experiment Water Cured		Avg. Strength as Com- pared with Same Mix Con- taining No Lime, Pct.	
			Gross Strength, pounds	Pct. of Strength Without Lime	Gross Strength, pounds	Pct. of Strength Without Lime	Net Strength, pounds	Pct. of Strength Without Lime	Net Strength, pounds	Pct. of Strength Without Lime		
Hydrated Lime Series												
60	1:6	None	943	100	1130	100	1315	100	1190	100	100	
61†	1:6	10†	945	100	1235	109	1540	117	1280	108	107	
62†	1:6	20†	1204	128	1180	104	1950	148	1610	135	114	
63†	1:6	30†	....	....	1211	107	1980	150	2010	170	133
64†	1:6	40†	....	....	1005	89	3520	270*	2800	235*	130
65†	1:6	50†	....	....	888	79	2305	175	2160	183	129
70	1:7	None	585	100	1016	100	1050	100	840	100	100	
71†	1:7	10†	707	123	1061	104	343	33*	239	29*	110	
72†	1:7	20†	957	162	1248	123	1030	103	1100	131	134	
73†	1:7	30†	....	....	1128	111	1520	145	1260	150	128
74†	1:7	40†	....	....	1379	136	1425	135	1310	156	141
75†	1:7	50†	....	....	1270	125	1365	130	1330	158	135
80	1:8	None	575	100	663	100	705	100	715	100	100	
81†	1:8	10†	622	110	852	128	890	139	980	137	125	
82†	1:8	20†	710	121	724	109	780	111	930	130	117	
83†	1:8	30†	....	....	925	139	1157	164	1130	158	150
84†	1:8	40†	....	....	958	144	1165	166	1365	191	161
85†	1:8	50†	....	....	888	134	1125	157	1125	157	145
60	1:6	None	943	100	1130	100	1315	100	1100	100	100	
61†	1:6	22½†	1109	118	1125	99	2225	171	2020	170	129	
62†	1:6	45†	....	....	1198	107	2015	154	2310	195	141
63†	1:6	67½†	....	....	887	78	1770	135	1955	164	113
64†	1:6	90†	....	....	1216	103	1710	130	2130	179	129
65†	1:6	112½†	....	....	940	83	....	....	....	....	?
70	1:7	None	585	100	1016	100	1050	100	840	100	100	
71†	1:7	22½†	1007	172	985	97	1380	131	1735	207	135	
72†	1:7	45†	....	....	943	96	1105	105	1690	201	125
73†	1:7	67½†	....	....	733	74	1790	170	1705	202	130
74†	1:7	90†	....	....	780	79	2005	192	1525	181	133
75†	1:7	112½†	....	....	689	68	....	....	....	....	?
80	1:8	None	575	100	663	100	705	100	715	100	100	
81†	1:8	22½†	837	145	756	114	1085	154	1230	172	141	
82†	1:8	45†	....	....	989	149	900	127	810	113½	134
83†	1:8	67½†	....	....	774	116	1240	176	1115	156	141
84†	1:8	90†	....	....	617	93	1140	162	955	133	120
85†	1:8	112½†	....	....	708	107	1215	172	970	135	128

NOTE—*Indicates that percentages were not used in computing averages.

†Indicates hydrated lime.

‡Indicates lime putty.

All strengths are average of 5 tests.

posited in four layers and each layer tamped the same amount, to stimulate as nearly as possible the casting machine. Each batch made ten specimens and was mixed 3 min. dry and 3 min. wet as in the second plant test. The cylinders were stripped vertically and moved to a rack immediately after casting. The curing methods were as noted above and storage was inside at the normal temperature for the month of August.

These specimens were prepared for test according to the standard methods.

Each of the strengths recorded in Table 2 is the average for five specimens broken.

Discussion of Results.

The value of any true investigation in this field is dependent to a large extent on the number of determinations made. The more values that are included, the nearer the result approaches the fact.

In this investigation into the effect

of lime on concrete products there are included three entirely different conditions of manufacture. A total of over 1,500 tests have been made. In general, every value in the tables is the average of 5 determinations and the curves shown on the plates are the average of 15 to 60 test operations.

Appearance.—No single quality of a concrete product has greater effect on marketability than appearance. A product may be sufficiently strong, thoroughly durable, and yet if its appearance is not pleasing, it will be sold with difficulty. Observation in these experiments shows that the color of the concrete is changed from a dark grey when no lime is used to a lighter grey as the lime content of the mix increases. It was noticeable during these tests that the texture of the surface becomes finer as the percentage of lime is increased. The interior texture as observed in many fractures is much denser with lime than without. The appearance of these

TABLE 3.—EFFECT OF LIME ON COMPRESSIVE STRENGTH AFTER 28 DAYS

Tabulation of Results of Block Test No. 2 at Ages of 1, 3 and 6 Months
All Strengths Are Average of 5 Tests

Marked	Proportion Cement to Aggregate	Lime Per Sack of Cement	(Strength in lb. per sq. in. Gross Area—)			6 Mo. Strength as Pct. of 28-Day Strength
			Age 28 Days	Age 3 Mos.	Age 6 Mos.	
60	1:6	None	1130	1086	1235	109
61†	1:6	10†	1235	1038	1350	109
62†	1:6	20†	1180	1119	1370	116
63†	1:6	30†	1211	1317	1410	116
64†	1:6	40†	1005	953	1360	135
65†	1:6	50†	888	973	1275	143
70	1:7	None	1016	839	1015	100
71†	1:7	10†	1061	1059	1115	105
72†	1:7	20†	1248	1161	1170	94
73†	1:7	30†	1128	1131	1200	106
74†	1:7	40†	1379	1195	1275	93
75†	1:7	50†	1270	973	1495	118
80	1:8	None	663	770	805	121
81†	1:8	10†	852	1043	965	112
82†	1:8	20†	724	1326	960	132
83†	1:8	30†	925	1419	1360	142
84†	1:8	40†	958	1434	1165	122
85†	1:8	50†	888	1478	1155	130
60	1:6	None	1130	1086	1235	109
61†	1:6	22½†	1125	1760	1585	141
62†	1:6	45†	1198	1629	1625	135
63†	1:6	67½†	887	1484	1315	148
64†	1:6	90†	1216	1603	1560	123
65†	1:6	112½†	940	1140	1180	125
70	1:7	None	1016	839	1015	100
71†	1:7	22½†	985	1536	1575	160
72†	1:7	45†	943	1508	1315	139
73†	1:7	67½†	733	1010	1010	150
74†	1:7	90†	780	1051	1070	139
75†	1:7	112½†	689	800	890	129
80	1:8	None	663	770	805	121
81†	1:8	22½†	756	779	782	103
82†	1:8	45†	989	1198	1175	119
83†	1:8	67½†	774	1022	1095	141
84†	1:8	90†	617	781	980	150
85†	1:8	112½†	708	1069	860	122

NOTE—†Indicates hydrated lime.

‡Indicates lime putty.

TABLE 5.—EFFECT OF LIME ON CURING METHODS
Tabulation of Results of Laboratory Experiment No. 2

Method of Curing							
Steam ...	1 day	1 day	1 day	.....	.....	1 day	.....
Spray ...	.....	.....	.....	.....	.....	.....	1 day
Sprinkle ..	6 days	20 days	.....	.....	.....	20 days	6 days
Storage ..	21 days	7 days	27 days	28 days	.....	7 days	21 days
Marked	Mix	Lime, lbs.	Crushing Strength in Pounds per sq. in., Net Area				
62†	1:6	20†	1200	1600	685	1970	2360
72†	1:7	20†	1130	1240	805	910	1695
82†	1:8	20†	1310	1535	655	860	1590
62‡	1:6	45‡	2360	2840	1575	1530	2400
72‡	1:7	45‡	1740	1842	1500	382	750
82‡	1:8	45‡	1130	1542	636	352	1180

NOTE—†Indicates hydrated lime.

‡Indicates quicklime putty.

All values are the average of five specimens.

PLATE NO. 2
(See Table No. 2 for data)

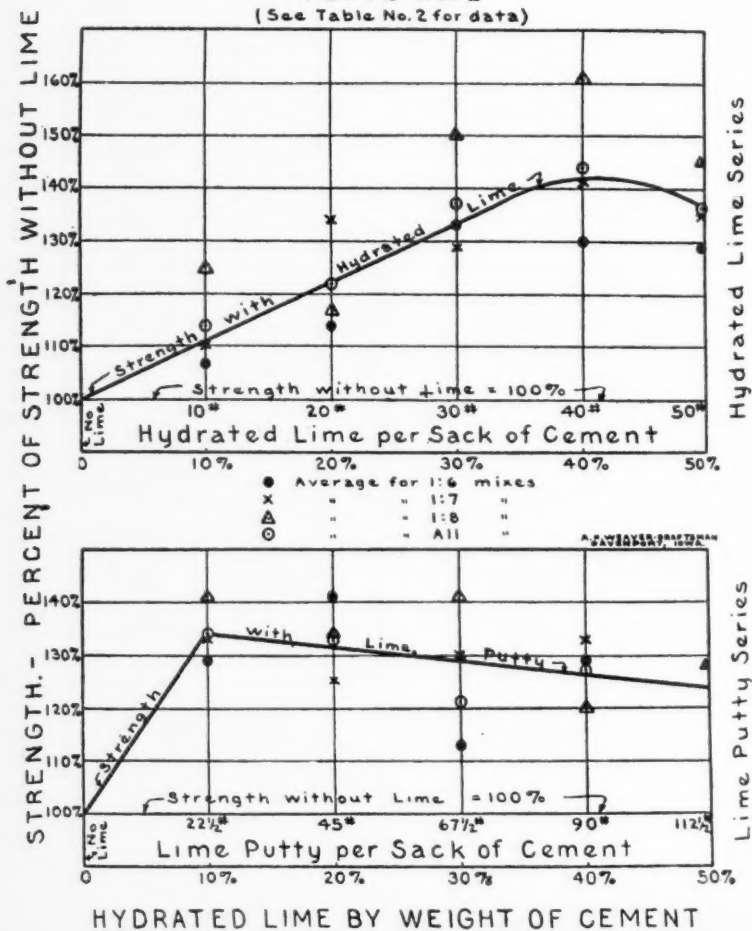


Figure 7—Effect of Lime on 28 Degree Compressive Strength

blocks is improved by increasing amounts of lime.

28-Day Strength.—In general, the results of this investigation show that both hydrated lime and lime putty give increased strengths to concrete products for all percentages of lime added. There are some exceptions, but the increases far exceed the decreases and in almost every case the apparent loss in strength is shown by other tests to be due to the variables of manufacture.

The 28-day strengths were determined in four tests: Two tests were made at concrete block plants and two tests were made as laboratory experiments. The two laboratory experiments are considered as one test since the specimens for both experiments were mixed in one batch. Throughout the laboratory tests the standard methods of testing were used.

A summary of compressive strengths, percentages of increases or

decreases and average percentages of increase as compared with those without lime are given in Table 2.

It is apparent that the strength, due to the addition of hydrated lime, increases with considerable uniformity up to 40 per cent. It is also evident that the leaner the mix, the greater is the advantage obtained by the use of hydrated lime. This last bears out the indications given in Bulletin 8 of the Lewis Institute. From these results it appears that up to 40 per cent hydrated lime gives an increase in strength of approximately one per cent for each pound of lime added per sack of cement.

Effect of Lime Putty or 28-Day Strength.

With this in mind, blocks were cast in Test No. 2 for crushing at various ages from one month to two years, with extras so that the five-year breaks could be made if deemed neces-

TABLE 4.—EFFECT OF LIME ON ABSORPTION, PERMEABILITY AND DAMPNESS PENETRATION

Results of Plant Block Test No. 2

Marked	Proport'n Cement to Aggregate	Lime per Sack of Cement, lbs.	Absorption by 24 Hour Immersion, Per Cent.	12 ins. of Water Impounded on Face for 24 Hours		
				Absorption Per Cent. Dry Wght.	Per Cent. of Imper-vious Units	Penetration of Dampness, ins.
Hydrated Lime Series	60	1:6	None	5.96	3.12	40
	61†	1:6	10†	6.55	2.65	80
	62†	1:6	20†	6.03	2.22	100
	63†	1:6	30†	7.00	2.27	100
	64†	1:6	40†	7.79	2.45	100
	65†	1:6	50†	7.25	3.09	100
	70	1:7	None	6.67	3.46	20
	71†	1:7	10†	7.13	3.64	100
	72†	1:7	20†	7.46	3.20	100
	73†	1:7	30†	7.63	3.35	100
Quicklime Putty Series	74†	1:7	40†	5.90	3.28	100
	75†	1:7	50†	6.02	2.04	100
	80	1:8	None	5.97	3.11	60
	81†	1:8	10†	6.52	3.65	80
	82†	1:8	20†	6.57	3.78	100
	83†	1:8	30†	6.12	2.26	100
	84†	1:8	40†	6.28	2.47	100
	85†	1:8	50†	7.14	3.05	80
	60	1:6	None	5.96	3.12	40
	61†	1:6	22½†	5.60	2.21	60
Quicklime Putty Series	62†	1:6	45†	6.25	2.51	100
	63†	1:6	67½†	6.98	3.13	100
	64†	1:6	90†	6.87	2.33	100
	65†	1:6	112½†	5.87	2.68	100
	70	1:7	None	6.67	3.46	20
	71†	1:7	22½†	5.90	2.36	80
	72†	1:7	45†	6.08	2.36	100
	73†	1:7	67½†	7.00	2.90	100
	74†	1:7	90†	6.60	2.76	100
	75†	1:7	112½†	8.37	3.58	100
Quicklime Putty Series	80	1:8	None	5.97	3.11	60
	81†	1:8	22½†	6.54	3.02	100
	82†	1:8	45†	5.96	2.65	100
	83†	1:8	67½†	6.75	3.72	100
	84†	1:8	90†	6.99	3.50	100
	85†	1:8	112½†	7.77	4.10	100

NOTE.—†Indicates hydrated lime.

‡Indicates lime putty.

All values are the average of 5 tests.

sary. The results are now available for the 28-day, 3 and 6-month tests as shown in Table 3. In some cases the 3-month strengths are somewhat below those at 28 days. As this occurs both in blocks with and without lime and is generally corrected at 6 months, it is believed that this condition is due to experimental error and uncontrolled conditions of manufacture.

The percentages of increase from 1 to 6 months are shown on Fig. 8. It is evident that there is no retrogression. All percentages of lime show increase in strength from 28 days to 6 months of age.

Absorption by Immersion.—The standard absorption test, immersion for 24 hours, is perhaps intended to be a measure of the durability of a product. The amount of water absorbed will certainly affect durability

under freezing conditions.

Absorption tests by this standard method were made and the results are reported in Table 4. The results confirm previous work and the average increase with lime is shown on Fig. 10. Absorption determined by standard immersion method is increased by the use of lime but remains well inside the specified limit.

Impounding Water on One Face

In considering the standard method of establishing absorption by immersing the specimen a certain length of time and determining the per cent of absorbed water by weight, it seemed that some pertinent facts were not obtainable. Water seldom comes in contact with more than one face of a water-tight block in actual practice. A reasonable method of test that more

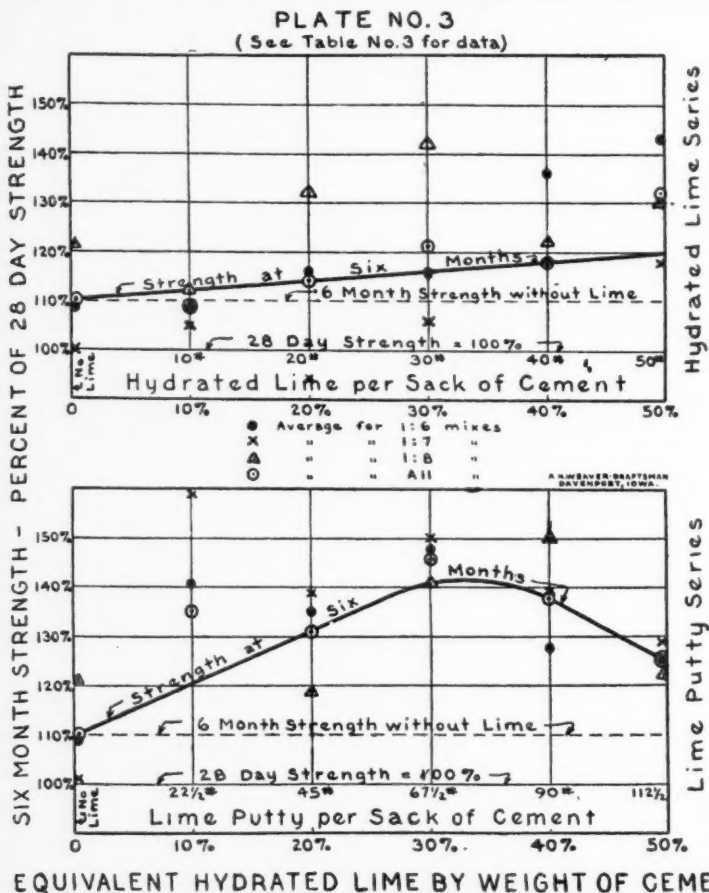


Figure 8—Containers For Impounding Tests

nearly simulated this condition would be interesting. Such a test should permit the study of absorption, penetration of moisture and permeability, all of which are important.

Attention is invited to the fact that two investigations showed extremely high increases in strength when lime putty was used, while one plant test did not show as much advantage until the tests at the age of three months. The reason for this delayed gain in strength is not clear. Considering that the increased strength due to the use of putty was very great, even though in one case it was not attained within the time limit, it is felt that further investigation will de-

velop material advantages in its use. It was observed that specimens made with lime putty could have been handled to storage much sooner than otherwise. However, this can only be proved by a plant test. Aged lime putty gives considerable increase in strength, and much quicker set than equivalent amounts of hydrate.

Strength Increased with Time

Retrogression or decrease in strength is a very serious and but rarely encountered condition in the concrete industry. This investigation would be incomplete unless it was definitely determined whether or not the addition of lime to concrete prod-

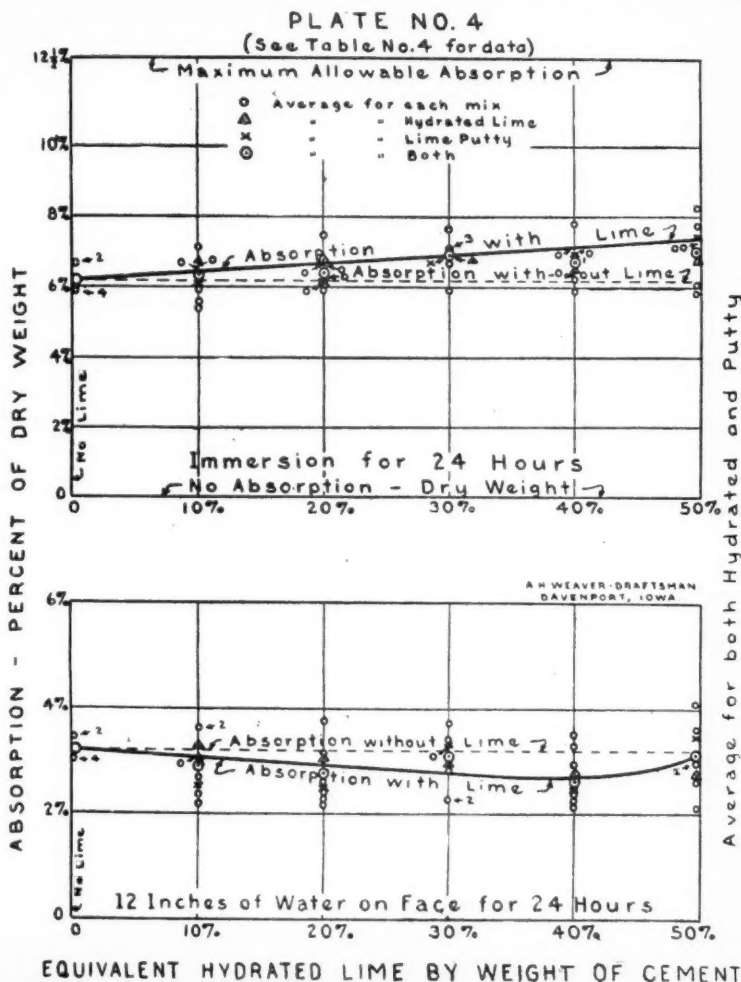


Figure 10—Effect of Lime on Absorption

ucts had a weakening effect over a period of time.

By means of a container bolted to the specimen it was possible to impound 12 inches of water on the face of a concrete block. A sponge rubber gasket makes the connection tight.

Five blocks of each of the 33 variables or 165 specimens made in the plant run at Cedar Rapids were tested in this manner.

Absorption on One Face.—The results obtained are shown in Table 4, and this information platted in figure 10 indicates that the total absorption into the exposed face is not increased by the use of lime.

Penetration of Dampness.—The depth to which dampness penetrates a specimen can be easily observed when the water is applied to one face only. The depth of dampness penetration is decreased as the lime content is increased. (See Table 4 and figure 11.)

Permeability.—The question of permeability is not touched in the standard absorption tests, but in this impounding test the water flowing through a specimen can be both seen and measured. In the series thus tested, 60 per cent of the units without lime were found to permit a measurable flow of water. The addition of 10 per cent of lime resulted

in 90 per cent imperviousness. Out of 120 units tested, containing 20 per cent or more of lime, only one leak was found. Permeability is apparently eliminated by 20 per cent or more of lime.

Economics of Lime in Concrete Products.—Any final discussion of the economics of this question is probably premature at this point in the investigation. The outstanding facts are that lime increases the strength of a product and improves other desirable properties. Increased strength can be utilized by obtaining a greater number of units per sack of cement when lime is used. These lime-cement units have certain advantages of appearance and water tightness that make for greater marketability.

Further plant tests will be necessary in order to determine the relation of the cost of the lime to the value of the advantages arising from its use. However, several concrete product plants have started using lime as this investigation has been developing.

The Climax Engineering Company, Clinton, Iowa, announce the appointment of the Briggs-Weaver Company, Dallas, Texas, as district representatives. This organization will handle the sale of Climax "Trustworthy" Engines for industrial purposes.

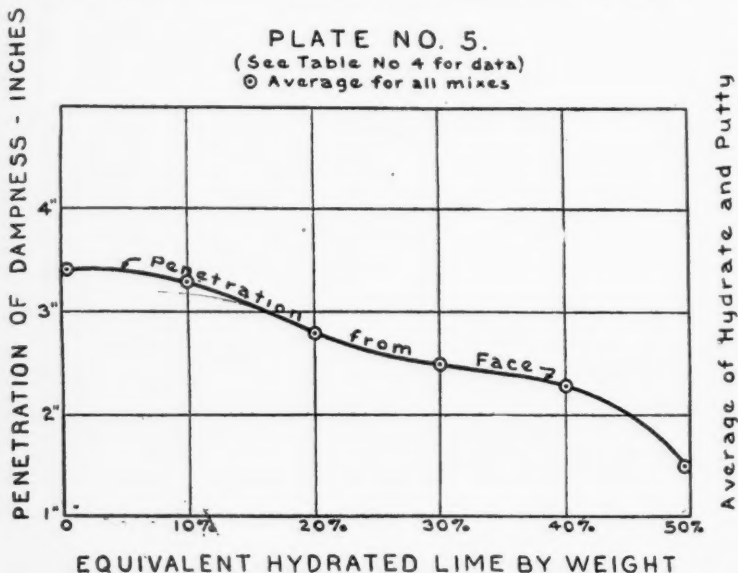


Figure 11—Effect of Lime on Dampness Penetration

Efficiency in Material Handling in a Marble Finishing Mill

By F. A. Westbrook

LYING close alongside the extensive West Rutland quarries, is mill number 19 of the Vermont Marble Company. This mill, which is primarily designed for the rubbing of square cornered slabs and blocks, probably is the most up-to-date operation of its kind by this concern. Because of its proximity to the vast quarries huge blocks are easily delivered to the mill on flat cars. The whole design and lay out of the mill is for the purpose of facilitating the handling of this heavy material.

The blocks of marble as they are taken from the quarry seldom weigh less than ten tons and sometimes reach three times that amount. Even after sawing up into the various commercial sizes the pieces taken to the rubbing department frequently weigh as much as five tons.

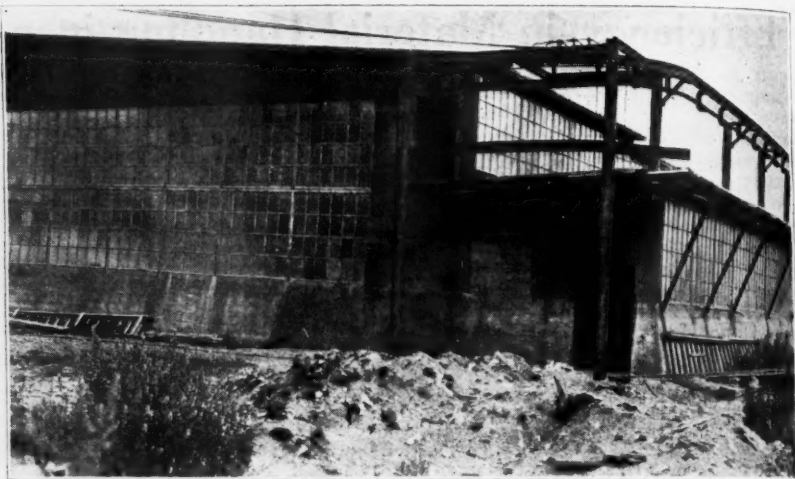
When the quarry blocks are brought to the mill the flat cars are run to a spot where the blocks can be picked

up by one of the travelling cranes. At present there are two 25 ton cranes and two 10 ton cranes. The two large cranes are at the ends because the quarry blocks are at the end of the craneway. The small cranes in between handle the sawed pieces after they come from the mill. A good many blocks are stored temporarily in the space under the cranes, but when they are to be sawed up the cranes place them on trucks which run on tracks at right angles to the length of the mill.

The lower portion of this side of the mill consists of a series of doors, one opposite the platform of each of the 24 gang-saws. For each of these platforms there are tracks which run out at right angles from the doors into the space under the traveling cranes. Within the mill, and extending its full length along the side adjacent to the outside traveling cranes, is a line of tracks on which an electric



Sawed Blocks Being Lifted By Crane to Truck in Wash Room

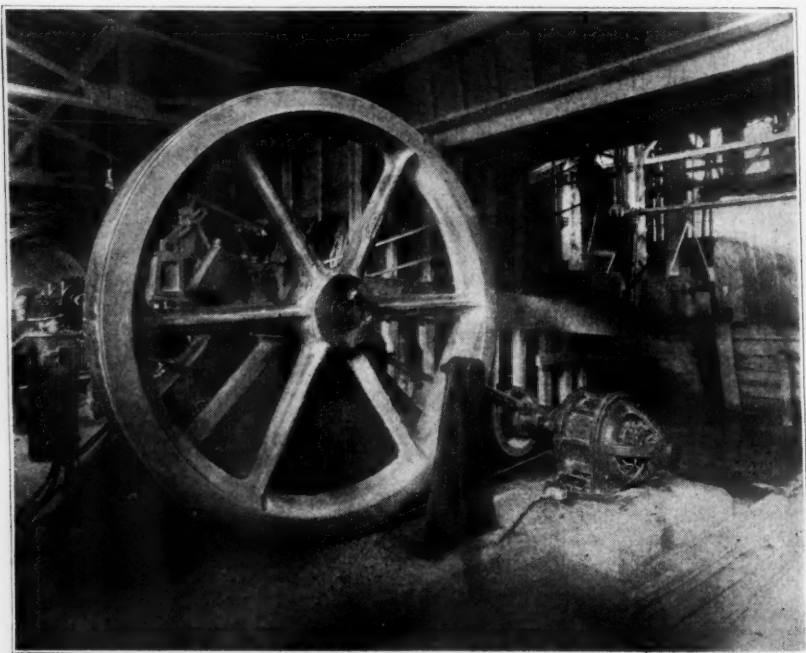


Monorail For Sand Bucket Entering Mill

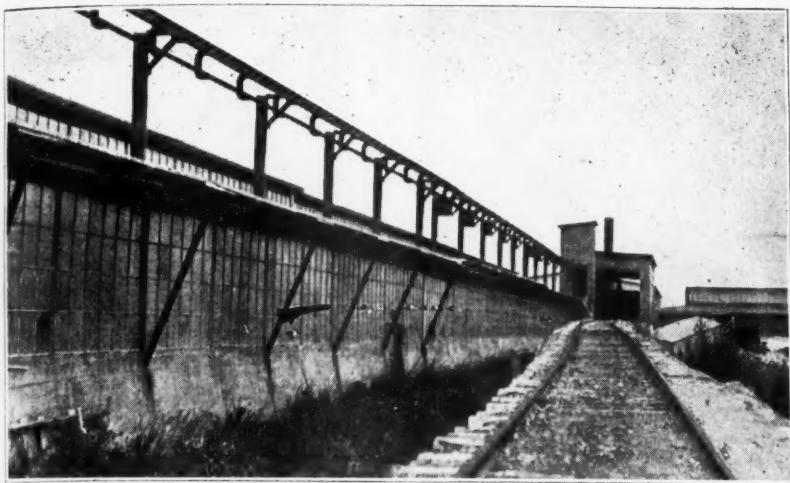
locomotive operates. At each end of this locomotive is a platform provided with tracks which form a continuation of the tracks extending out under the cranes.

One of the large quarry blocks is placed on a truck outside and pulled

across the tracks on the locomotive and into the mill onto similar tracks extending on to the platform of a gang-saw. This horizontal pulling operation is done by machinery on the locomotive by means of a cable passing around pulleys. When the truck



Detail of Motor Drive For Gang Saws



Railroad Tracks For Bringing Sand and Monorail

carrying the quarry blocks is in position under the gang-saw it is securely blocked in position and the sawing is done right on the truck.

When the sawing is completed the truck is pulled back on to the locomotive which carries it down the length

of the mill to the "wash house" where it is again drawn off in the same way into compartments, under the traveling crane in the mill. Here the marble is sorted over and certain pieces sent back for cutting into blocks, rubbing, or other work. Pieces may be brought



Outside Traveling Crane



Gallery in Gang Saw Mill



Shipping Platform

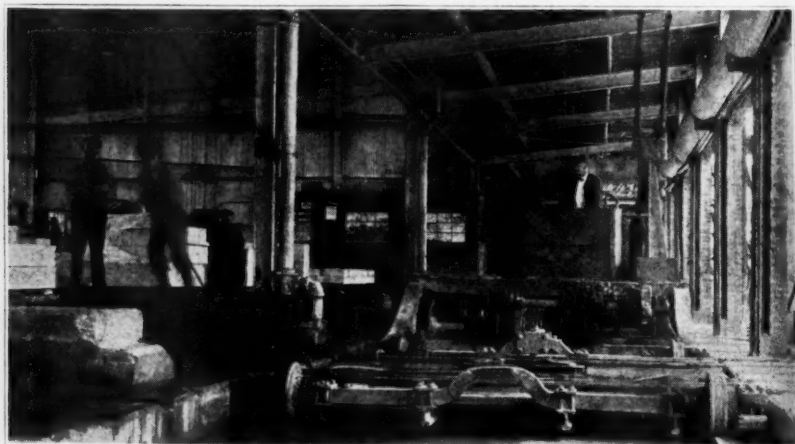
into these compartments from the outside in the same way as they are placed under the gang-saws.

This traveling crane, of 10 ton capacity, is used to place the pieces on the rubbing beds or elsewhere as desired. It has two 40 h.p. motors for hoisting, high speed for small pieces and slow speed for large pieces, a 40 h.p. for traveling and 5 h.p. for the trolley. This part of the mill housing the "wash room," rubbing beds or crating department is provided with

a saw tooth roof.

The electric locomotive was manufactured by the F. R. Patch Company of Rutland, Vermont, and is operated by direct current. Two overhead contact trolleys are used. This is considered more satisfactory for this work than ground return. It is provided with 4 motors—two 18 h.p. for moving the locomotive and an 18 h.p. for moving the trucks at each end.

The large outside traveling cranes are equipped with two hoists each, one



Electric Locomotive and Trucks With Sawed Blocks.

25-ton and one 5-ton. Each of these is operated with a 40 h.p. motor, the smaller hoist working much faster than the larger, and the bridge travel is accomplished by means of another 40 h.p. motor. The trolley is run by a 5 h.p. motor.

The 10-ton outside cranes have only one hoist and have a 40 h.p. motor for the hoist, a similar one for the travel of the whole crane, and a 5 h.p. motor for the trolley. All of the cranes, as well as the locomotive, are operated by direct current furnished by a motor generator set.

The gang saws are driven by 10 h.p. individual induction motors. There is also a 3 h.p. motor to drive a rotary pump for every two gangs to furnish water and sand. In addition to this, 3 h.p. motors are provided for every two gangs to raise and lower the saws.

Large quantities of sand are required for the gang-saws and rubbing beds. This is brought by railroad from Proctor and is dumped into pits at the end of the gang-saw department adjacent to the rubbing room.

The stand is distributed to the saws by buckets traveling on a monorail which goes from the bins along the outside of the building and enters the other end. The buckets are first lowered to the bottom of the bins by an elevator, filled by gravity, and then raised up to the monorail by another elevator. The grade of this monorail favors the travel of the loaded buckets which are pushed by hand. Inside the mill there is a small sand storage bin for each two gang saws which is kept

filled from the buckets by men especially detailed to that work. Illustrations printed here show the gallery from which sand tanks above each gang saw are filled, with extra piles of sand on the floor.

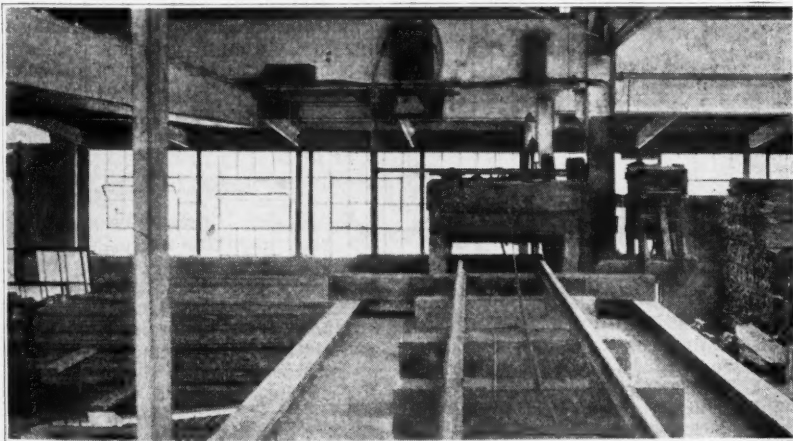
Sand for the rubbing beds is distributed in a different manner. There is an elevator track in the finishing department on which a small dump car passes close to these machines. One end of the track is near enough the sand bins to permit loading the cars by gravity chutes and it is then pulled by cable passing around an electrically operated drum, and dumped into the proper receptacles at the rubbing machines.

The finished pieces of marble are placed, usually with the help of a chain hoist, on a small hand pushed truck and taken to the crating department. They are taken out in the same way to the shipping platform.

A circular motor driven wood saw is used in the making of crates.

At the present time a large addition to mill 19 is under construction as it has been found that the equipment and lay out of the existing mill has been so economical and satisfactory as to justify the gradual discontinuance of older methods of manufacture.

The Diamond Power Specialty Corporation, manufacturer of Diamond Soot Blowers, announces the appointment of Mr. J. E. Heeter as manager of the Philadelphia Office. Mr. Heeter succeeds Mr. M. J. Miller, transferred to the Detroit territory.



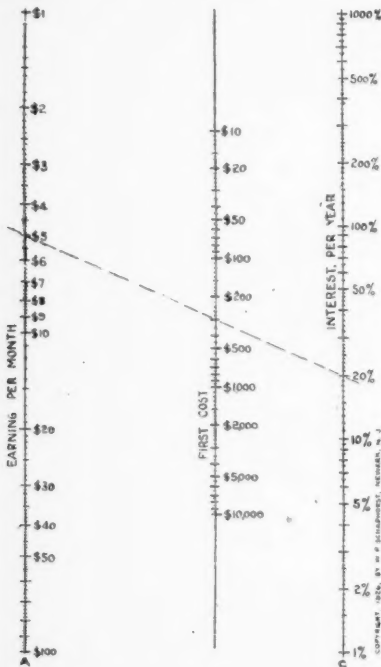
Elevated Track For Hauling Sand to Rubbing Bed

What Per Cent Profit?

By W. F. Schaphorst

The accompanying chart quickly tells you what your annual profits are. Most of us very commonly underestimate the money earning value of equipment. Thus, for example, if you spend \$300 for a certain machine and if it earns "only" \$5 per month for you, that amount probably does not look like very much to you. Yet, it is 20 per cent interest per year on the first cost. Twenty per cent is a high rate, usually.

To use the chart is very simple. Merely run a straight line through the Earning per Month, Column A, and the First Cost, Column B, and the intersection with Column C gives the interest per year. Nothing could be easier.



Thus, choosing the example stated above, if the earning per month is \$5 and the first cost is \$300, the dotted line drawn through the \$5 Column A, and the \$300, Column B, intersects the 20 per cent mark in Column C. Therefore the annual interest earned by the \$300 is 20 per cent.

The chart will also be found useful

for determining the amount of returns per month that should be expected from a given machine of known cost. For example, if you know that a machine will cost \$300 and you want to make at least 20 per cent, run a straight line through the two known values, \$300 and 20 per cent, and the intersection with Column A gives the answer as \$5 per month.

The chart may be used also for determining the limiting amount of money you can spend for a given machine, knowing the income per month that you can get out of it and knowing the interest rate per year that you want. In other words if you know the values in any two columns you can immediately determine the third by running a straight line through the two known points. Nothing could be simpler.

The range of the chart, as will be noted, is great enough to take care of most problems—the earnings per month ranging all the way from \$1 to \$100. The first costs, Column B, range all the way from \$10 to \$10,000. And the interest rates, vary all the way from 1 per cent to 1,000 per cent, Column C.

This chart is also usable for figures larger than those shown in the chart. For example, if the earning per month is \$500 and the first cost \$30,000, the same dotted line would be drawn across giving the result as 20 per cent interest per year. In other words, when you add two ciphers to any figure in Column A, you must also add two ciphers to any figure in Column B. If you add 3 ciphers in A, also add three ciphers in B. In other words, always add as many ciphers in A as in B.

H. H. Snell, formerly manager of the gear department for Chas. Bond Company, Philadelphia, has recently been appointed as district representative for Foote Bros. Gear and Machine Company of Chicago. His territory covers Eastern Pennsylvania, Delaware, Maryland and the southern half of New Jersey. Chas. Bond Company, former representatives for Foote Bros. Gear & Machine Company will still continue to handle the IXL Line as jobbers.

Physical Chemistry of the Calcium Sulphates, and Gypsum Reserves

By Oliver Bowles² and Marie Farnsworth³

THE gypsum industry has shown remarkable growth during recent years, production in 1923 amounting to four and three-quarters million tons valued at nearly thirty-five million dollars. Therefore, the question of reserves is assuming increasing importance.

The stability relations of gypsum and anhydrite, and the various conditions under which they may be formed, or may exist in nature have never been thoroughly worked out. Research recently conducted at the Nonmetallic Minerals Experiment Station of the Bureau of Mines has brought out certain facts that may be of interest to the geologist and to the chemist, and at the same time may have a direct bearing on the future of gypsum mining operations.

The mineral anhydrite occurs in large quantities in some gypsum mines. At the present stage of technical progress it is difficult to market and constitutes a serious handicap in mining operations. The claim has been made, and seems to be fully substantiated that an increase in the proportion of anhydrite may be expected as greater depths are attained in the mines, thus the future of the industry is beset with increasing difficulties. The data developed through bureau research are directly related to the occurrence and stability of gypsum and anhydrite, both at the surface and under a heavy load of superimposed rock.

Gypsum deposits of commercial size are said to be formed in four principal ways as follows:

1. Direct deposition by evaporation of sea water.
2. Concentration of disseminated gypsum by moving waters.
3. Alteration of limestone beds by acid sulphate waters.
4. Alteration of anhydrite.

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³Supintendent, Nonmetallic Minerals Experiment Station, Bureau of Mines, (In coöperation with Rutgers University, New Brunswick, N. J.).

²Assistant Chemist, Bureau of Mines.

A brief discussion of these methods follows:

1. *Direct Deposition.*—As shown by Van't Hoff, when a solution of pure calcium sulphate in water is evaporated at a temperature below 66° C. gypsum is deposited; if above 66° C. it deposits as anhydrite. When, however, other soluble salts, particularly sodium chloride, are present, anhydrite precipitates at temperatures as low as 30° C., and gypsum deposited below that temperature will, in the presence of a saturated sodium chloride solution, change into anhydrite. In the evaporation of sea water the lower temperature limit at which anhydrite crystallizes is 25° C. It seems probable, therefore, that conditions of solar evaporation in dry climates have commonly been favorable for the deposition of anhydrite, and that a large part if not the major part of calcium sulphate beds originating in this way, has been deposited in the form of anhydrite rather than gypsum.

2. *Concentration by Moving Waters.*—Gypsum is soluble in water in the proportion of about one part in 386 at a temperature of 18° C. Therefore, disseminated gypsum may be readily dissolved, and may later be deposited in beds. Intermittent streams in arid regions provide favorable vehicles for such concentration. The earthy form known as gypsite is derived from primary deposits through circulation of ground waters.

3. *Alteration of Limestone.*—Some large deposits of calcium sulphate have resulted from the alteration of limestone beds by the action of acid sulphate waters, commonly derived through decomposition of disseminated pyrite in the limestone or adjacent beds. Other calcium-bearing minerals may be changed in a similar manner. Clark⁴ claims that much of the calcium sulphate thus formed goes into solution, is carried away, and may later be deposited as a saline residue. Dana⁵ states that much gypsum of the Salina formation in New York resulted from action of acid sulphate

waters on limestone. Either anhydrite or gypsum may result from such chemical reaction depending on conditions. As in the case of sea-water deposition the character of the deposit depends largely on the temperature at which the reaction takes place. At temperatures between 30° C. and 66° C. varying with the concentration of salts present, anhydrite will be formed at lower temperatures gypsum will result. As will be pointed out later pressure probably has little effect on the reaction.

4. *Alteration of Anhydrite.*—Until recent years anhydrite was regarded as an uncommon mineral in the United States. Dana's "System of Mineralogy," 6th edition, 1892, gives only three United States localities. Rogers' writing in 1914 records 60 localities where anhydrite occurs in this country, some of the deposits being of large extent. Other extensive deposits have been noted since that time, especially by Stone¹ in his work on gypsum resources. Many important deposits of gypsum have resulted from alteration of anhydrite. Gypsum is the stable form of calcium sulphate at or near the surface of the earth, and the slow hydration of anhydrite through geologic ages may have formed zones of gypsum 100 to 300 or 400 feet thick resting on unaltered anhydrite. Large gypsum deposits in Nova Scotia and in Texas have undoubtedly been formed in this way. Rogers' attributes all the gypsum occurring near the town of Gypsum, Eagle County, Colo., gypsum in the Ludwig mine and at Mound House, Lyon County, Nev., also the gypsum in the Rising Star Mine, Shasta County, Calif., to hydration of anhydrite. Rogers' conclusion based on wide observation is as follows "From all the available evidence it seems certain that many, if not most, of the gypsum beds have been formed by the hydration of sedimentary anhydrite." Clarke² refers to a gypsum bed 60 to 100 feet thick at Bex in Switzerland, formed by alteration of anhydrite. Newland³ notes a change to the anhydrous form at depths beyond 100 feet in the western New York district. This would indicate that the calcium sulphate was formed primarily as anhydrite, and that the latter is slowly hydrating to gypsum near the surface by the action of ground water. Stone¹ describes many occurrences of anhydrite where associated gypsum beds have with

reasonable assurance been formed by hydration of anhydrite.

It is evident from the above that anhydrite is abundant in nature, and that many commercially important gypsum deposits have been formed by surface alteration of anhydrite. The former belief that the occurrence of anhydrite is somewhat restricted was due in part to the fact that anhydrite rarely occurs at the surface, the exposures being hydrated to gypsum, and in part to the misinterpretation of drill records. Drill cuttings in many places designated as gypsum may have been anhydrite, for the powdered minerals are similar, and furthermore, some of the designations may have been based on chemical tests for sulphur and calcium without reference to the water content.

Experimental Data

The tests and studies conducted by the Bureau of Mines have furnished interesting data on the stability relations of the two minerals. It was found that anhydrite placed in pyrex glass bombs with water was unchanged under a temperature of 210° C. and a pressure of 19 atmospheres. Gypsum similarly treated changed over to anhydrite at a temperature of about 160° C. This establishes the fact that anhydrite is the stable form of calcium sulphate under conditions of high temperature accompanied by pressure.⁴ In these tests temperature and pressure were increased simultaneously and therefore, no evidence is afforded as to how much of the effect is due to pressure and how much to temperature. As all pressure tests in the experiments conducted were made by heating the mineral with water in bombs, for every increase in pressure there was a corresponding increase in temperature, and it was not possible to obtain experimental evidence of the effect of pressure alone. Fairly definite conclusions may be reached, however, on a theoretical basis. From a study of the volume relations of gypsum and anhydrite, it appears that gypsum should be the stable form under high pressures. One thousand grams of gypsum occupy a volume of 431 cc. since gypsum has a density of 2.32; this weight of gypsum decomposes to give 791 grams of anhydrite and 209 grams of water. The anhydrite having a density of 2.96 would occupy a volume of 267 c.c.; the water would occupy a volume of 209 c.c.; the total

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volume would thus be 476 c.c. Therefore, since the combined volume of the anhydrite and water is more than the volume of the gypsum, hydrostatic pressure should tend to form gypsum from anhydrite and water.

When water is present with anhydrite at low temperatures gypsum is slowly formed. From the volume relations given above the conclusion may be reached that pressure tends to accelerate the reaction, but no experimental data bearing on this problem have been noted. It may be concluded, therefore, that while anhydrite is stable under conditions of high temperature and pressure, temperature is the controlling factor as it overcomes entirely the opposite tendency of pressure to form gypsum rather than anhydrite.

In the case of hydrostatic pressure on gypsum there is no doubt as to what will happen. The anhydrite and water occupy a larger volume than the gypsum, and therefore pressure will not cause a reaction to take place that results in a larger volume. In other words, gypsum subjected to uniform pressure will remain gypsum no matter how high or low the pressure may be, provided the temperature is not higher than the decomposition point of gypsum at that pressure.

In the case of non-uniform pressure the conditions are not so simple. This is a phase rule problem over which there has already been a great deal of controversy without any final conclusion having been reached. One equation applying to this condition was first developed by Riecke¹ in 1894 and is as follows:

$$\log \frac{\theta}{\theta_0} = \frac{-eV_s\pi}{2\lambda},$$

where θ and θ_0 are temperatures, e is the reciprocal of Young's modulus, V_s is the specific volume of the solid, π is the thrust in dynes per sq. cm., and λ is the latent heat of the solid. The other equation that applies to the same condition is

$$\log \frac{\theta}{\theta_0} = \frac{-V_s\pi}{\lambda},$$

and has been discussed by Williamson² and by Johnston and Adams.³ From the first equation it may be stated as a general theorem that the dissociation point at the free surface is depressed in consequence of any stress by an amount dependent on the latent heat and the work done on unit mass. In the second case, at the

thrust surface, the melting point is depressed by pressure but raised by tension, being dependent on π and not on π^2 . The amount is also much larger than for the free surface. It is known, for example, that a certain hydrostatic pressure will melt ice at -5°C ., but if a thrust is put on the ice and it is then melted with hydrostatic pressure much less pressure is needed if the ice can melt at the thrust surface but only a very slightly less pressure if the melting must take place on the free surface.

For gypsum the case is analogous; that is, if a thrust is exerted on gypsum and the decomposition takes place at the free surface, the effect of pressure is very small. If, however, decomposition takes place at the thrust surface, the effect of pressure is quite large and according to equation (2) it is possible to force water out of the gypsum. Theoretically this is possible but in practical application the question arises as to whether a semi-permeable wall which would permit water to escape would be capable of acting as a medium of sufficient pressure to bring about the change. This seems highly improbable and from evidence now available, it can only be concluded that anhydrite and water are probably rarely formed from gypsum by the application of pressure.

Wallace⁴ confirms this conclusion in the following statement: "There is an increase of volume in the transformation gypsum \rightarrow anhydrite + water, and although the liquid phase will at once seek regions of lower pressure, it is the volume relationship at the moment of transformation that regulates transformation conditions." He further states "direct geological evidence has yet to be adduced before the theory can be accepted that transformation of gypsum to anhydrite, at great depths below the surface, takes place to such an extent as to be of geological importance."

The conditions may be briefly summarized in the statement that the reaction

$\text{CaSO}_4 + 2\text{H}_2\text{O} \rightleftharpoons \text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
is reversible—very slowly toward the right at temperatures below 66°C ., though accelerated somewhat by pressure; to the left retarded by pressure at low temperatures, but accelerated rapidly by increase in temperature above 66°C . The occurrence of anhydrite with increasing depth in mines is due, therefore, not to a change of gypsum to anhydrite with increasing

pressure, but to the fact that anhydrite is the original form which has remained unchanged at depth. In other words, the order of occurrence as observed in nature is due to an alteration of surface anhydrite to gypsum, and not to a change of gypsum to anhydrite.

In the western New York gypsum beds which dip at low angles, an increase in the proportion of anhydrite may be noted in passing downward in the direction of the dip. Newland¹⁷ attributes this condition to the increasing permanent load which, he assumes, renders gypsum unstable below depths of 250 to 300 feet. It seems more reasonable, however, to assume that the original bed was entirely anhydrite, and that hydration by meteoric water in a slow downward progression has reached a depth of not more than 250 or 300 feet. The occurrence of anhydrite rather than gypsum in the original bed was evidently due to a favorable temperature and salt concentration, rather than to a high pressure.

What bearing have these conclusions on the problem of gypsum reserves? Though following a different line of reasoning in general they sustain Newland's claim that more and more anhydrite may be expected as greater depth is attained in gypsum mines. However, the absence of any decided effect of pressure indicates that gypsum may exist under heavy load, that it is possible for gypsum beds to remain indefinitely in the form of gypsum until such depths are reached that a temperature of about 66° C. is attained. Thus, if water is present, gypsum may be formed from anhydrite at any depth below the surface where the temperature is below the critical point, and in like manner gypsum beds carried far below the surface by rock folding may exist indefinitely if not dehydrated by heat.

¹⁴Clarke, F. W., "Data of Geochemistry," 5th edition, U. S. Geol. Survey Bull. 770, p. 556.

¹⁵Dana, J. D., "Manual of Geology," 4th Ed., p. 554.

¹⁶Rogers, A. F., "Notes on the Occurrence of Anhydrite in the United States," *School of Mines Quarterly*, Columbia Univ., vol. 36, p. 121.

¹⁷Stone, R. W., "Gypsum Deposits of the United States," U. S. Geol. Survey Bull. 697, 1920, pp. 19-21.

¹⁸Rogers, A. F., work cited, p. 127.

¹⁹Clarke, F. W., work cited, p. 229.

²⁰Newland, D. H., "Mineral Industry," vol. 28, 1920, p. 333.

²¹Stone, R. W., work cited, 1920, pp. 19-21.

²²For further details of these tests see Bu-

reau of Mines Reports of Investigations, Serial No. 2654, entitled "Effects of Temperature and Pressure on Gypsum and Anhydrite," by Marie Farnsworth, published in *Pit and Quarry* December 15, 1924.

¹⁸Riecke, E., *Ann. Phys.*, 54, 731 (1895).

¹⁴Williamson, E. D., *Phys. Rev.*, 10, 275 (1917).

¹⁵Johnston, John, and L. H. Adams, *Am. J. Sci.*, 35, 205 (1913).

¹⁶Wallace, R. C., "Gypsum and Anhydrite," *Geol. Mag.*, 1914, p. 275.

¹⁷Newland, D. H., "Relation of Gypsum Supplies to Mining," *Trans. A. I. M. M. E.*, vol. 66, 1922, p. 93.

Schofield-Burkett Draglines

The Schofield-Burkett Construction Company is marketing an improved scraper with an automatic loading attachment. The concern offers three types of machine. Type A is for excavating and loading into cars, trucks and hoppers all such materials as sand, gravel, loose stone, shale, marl, etc. Type B is made especially for stripping and wasting or piling overburden from gravel and clay pits and similar operations. The type C machine is a portable for gravel beds and similar operations.

If electrically driven, the manufacturers claim, their dragline requires but one man to operate. He is stationed at the triple drum hoists. If steam is used the services of a fireman are also required. Underwater digging, the manufacturers say, offers no obstacles for the S-B dragline. They also stress that the simplicity of the machine makes it possible for a common laborer to operate it and the village blacksmith to repair it. The hoist is designed to take care of extremely rough usage, and is mounted on an extremely heavy frame. Each drum shaft is made larger and has machine cut gears and especially designed thrust bearings. Steam outfits are fitted with over size boilers.

The self loading scraper ranges from one to five years capacity and is made of heavy plow steel plate and provided with reinforcing plates on the bottom. The plates and teeth are easily removed when worn.

The Mundy Sales Corporation has been organized to market and distribute the hoisting equipment manufactured by the J. S. Mundy Hoisting Engine Company. The sales corporation will direct the activities of the exclusive sales agents throughout the country.



What Makes It Dig So Fast?

You want to know why a Haiss Creeper Loader will average 2 to 2½ cu. yds. per minute?

There's no secret. *Every bucket digs a full load every time!* And that is because the Haiss patented slow-speed "Crowding" gear keeps pushing the machine hard up against the pile so that every bucket gets a full bite. Did you ever see a machine driven 39 inches a minute right through a pile? That's what happens with the Haiss Loader.

And it digs *through* the pile because the patented feeding device—those paddle blades on the extended tail shaft—keep digging up the material and piling it in front of the buckets. The action is positive and continuous.

Only Haiss Loaders have the features described. They are, however, only two of many features about which every man who handles sand, stone or other materials ought to be informed.

Why not ask us to send you Catalog 523 which tells the whole story—and gives some interesting cost comparison?

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THE GEORGE
-Truck and-
Wagon Loaders
Portable Belt
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Established 1896
MFG. CO. INC.
Clam Shell
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142nd St. and Rider Ave., New York, N. Y.

Representatives Throughout the World.

Cable Address "Coalholst" New York—"Western Union

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Forty Miles of Highway built



In the quarry, in the sand, gravel and clay pit, in the mine and in highway construction—anywhere, if tracks can be laid, the Plymouth is the economical hauler. Made in 3 to 20 ton sizes, and in any track gauge. Write for literature.

THE FATE-ROOT-HEATH COMPANY

PLYMOUTH

Gasoline

uilt in Remarkable Time



THE building of modern highways by modern methods demands rapid haulage.

A given stretch of highway holds just so much material, whether built in a day or a year.

Profits are made by laying the biggest linear footage in the least time.

The McCarthy Improvement Co. of Davenport, Iowa, had the contract for 40 miles of 18 ft. concrete pavement, including bridges and culverts, between the cities of Dixon and Rockford, Illinois.

Work was started April 1st, 1925, and finished November 15, in exactly 7½ months.

The largest day's run was 1,194 feet; largest week's run 7,344 feet.

Maximum haul was about 7½ miles over grades from 2 to 5 per cent.

Seven Plymouth 7-ton Gasoline Locomotives were used on this job. Mr. O'Brien, Vice-President, writes:

"No small amount of credit is due to the dependable service of your Locomotives, and to say the least we are very well pleased with their performance on this job."

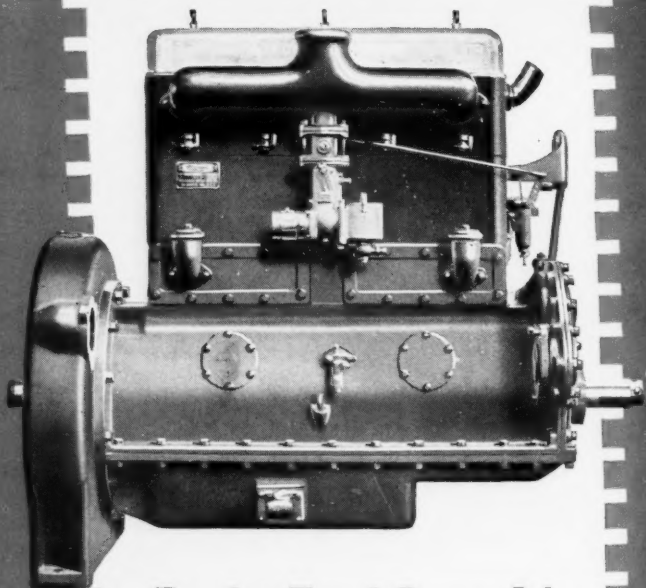
(Plymouth Locomotive Works), PLYMOUTH, O.

PLYMOUTH

Locomotives

Seven Plymouth Locomotives, owned by McCarthy Improvement Co., Davenport, Iowa, hauled all of the material for building miles of 18 ft. concrete highway in one season.

and highway and general economy of haulage.



For that Tough Power Job —Use the Big “K”!

Not just a truck motor sold separately, but a husky valve-in-head “Four” that turns up plenty of power at slow speed—and a world of it when you open ‘er up.

Model “K” was designed and built to fill this very definite need. Builders of cranes, shovels, dragline outfits, hoists and similar big units find this powerful motor furnishes just the kind of power they want.

Model “K” is simple, easy to “get at” and **ECONOMICAL!** Like all Wisconsin motors, it delivers, consistently, “More Power per Cubic Inch.”

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Wisconsin Motors are built in a full line of Fours and Sixes with a power range from 25 to 120 H.P. Also supplied in portable housed units for power-at-the-job.

Wisconsin Motor Mfg. Co.

Milwaukee,

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**MORE
POWER**



Handling Sand and Gravel Efficiently From Oregon Rivers

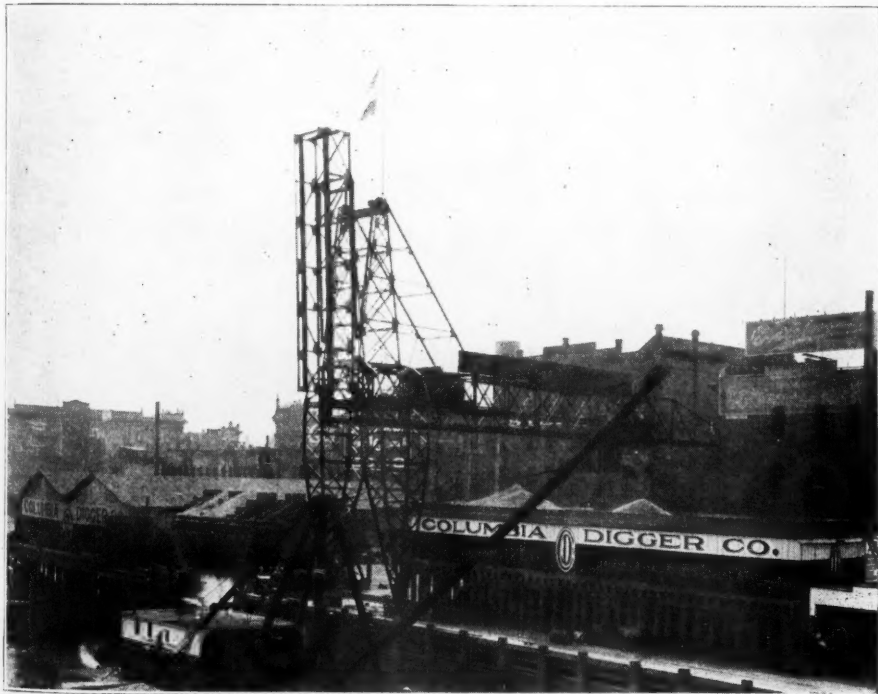
By E. D. Roberts

EIGHTY-FIVE to ninety per cent of the sand and gravel used in and about Portland, Oregon, is dredged from the beds of the Willamette and Columbia Rivers. Of this amount two men, H. F. Puariea and H. P. Warren, produce three-quarters of this percentage through the companies they own.

Portland, a city of over 300,000, is situated on the Willamette River eight miles above its junction with the Columbia River and at the head of deep sea navigation. As it is a rapidly growing industrial center considerable construction is in progress throughout the year. The climate is so mild concreting can be carried on without interruptions from freezing weather. Sand and gravel for this work comes in by barges either, to the bunkers of the sand and gravel companies, or directly to the job if

the material is to be used along the riverfront. In the first case, it is lifted from the barges to the bunkers by clamshell buckets operated by stationery hoists while, if it is delivered to the job, a floating derrick places the sand and gravel in position with a clam shell bucket.

The large amount of expensive equipment required to compete successfully in this field called for a producer who could deliver the sand and gravel directly to the barges of the small retailing companies. Later Mr. Puariea and Mr. Warren convinced a number of the larger operators that it would be to their interest to purchase their materials from them, thereby reducing their plant expense and the cost per yard. The gravel resources of the Willamette River are extensive and are practically inexhaustible due to the re-



The Unloading Plant of The Columbia Digger Company

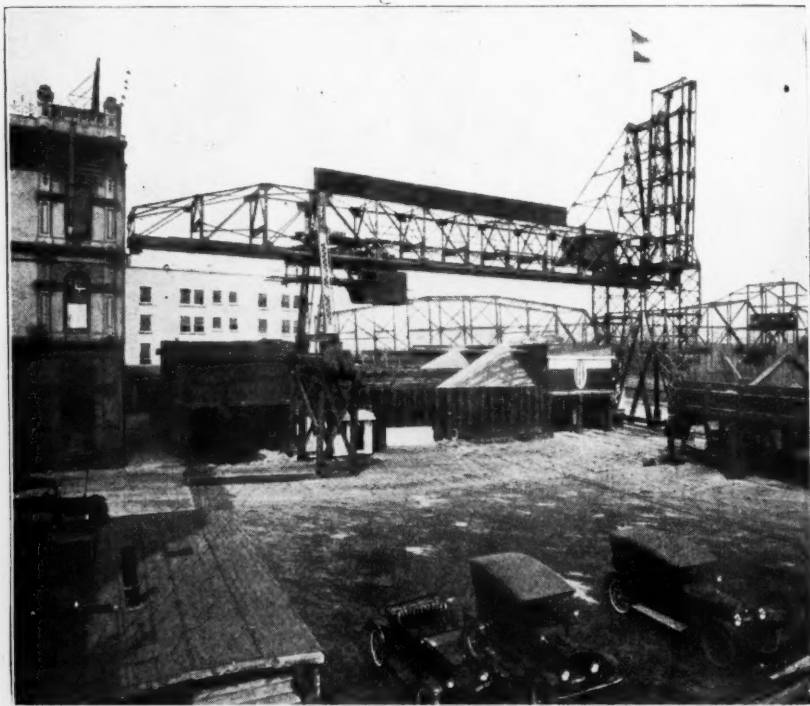
plenishing that takes place annually during the flood periods. There are three large tributaries of the Willamette River which bring in most of the gravel: the Clackamas, Santiam and Mackenzie Rivers. Each of these is short and broad with steep gradients carrying large gravel in flood stages. The Clackamas empties into the Willamette about 10 miles above Portland and is mainly responsible for gravel used in that city. The Willamette also carries considerable sand but, as it contains a good deal of silt and vegetable matter, it is rejected for use in Portland due to the large and cheap supply obtainable in the Columbia. This Columbia River sand, as it is known, is hard, sharp, and as it has been deposited by a large river with a very flat gradient flowing through a rocky country it is well graded.

In order better to keep track of the results of each dredge operation, and as the dredges were added one at a time, each dredge is owned by a separate company incorporate but owned and operated by Mr. Puariea and Mr. Warren. At present, they have three

companies: the Columbia Digger Company, producing sand from the Columbia River by a suction dredge; the Portland Gravel Company, producing washed and crushed rock and gravel from the Willamette River, and the Willamette Gravel Company, at present inoperative due to dismantling the old dredge and constructing a new one similar to the Portland Gravel Company's dredge, which they constructed this summer and placed in operation last August.

The Portland Dredge, designed and built by Mr. Puariea and Mr. Warren, is 32 feet wide by 118 feet in length with a draft of 3 foot 6 inches. As previous operations of ladder dredges have removed the gravel to a depth of from 40 to 50 feet, they designed this one to dig to 125 feet below water surface. However, they do not expect to go below 100 feet as the sand, which is wasted, begins to run in when working below that depth, thereby slowing up the output.

As before stated, the Willamette River Sand is not considered the best as it will not pass the city of Portland Specifications. The designers



Another View of The Unloading Plant and Dock of The Columbia Digger Company



The Stockton Bucket With A Load

took this into consideration and designed the screen to waste all material under $\frac{1}{4}$ inch in size by discharging it over the rear end of the dredge. Everything was laid out by the designers who then turned over the plans to the Hesse-Ertzed Machinery Company of Portland, for the detailing and manufacture of the special machinery required.

This dredge is of the clam shell bucket type using a $2\frac{1}{2}$ yard Stock-

ton clam shell bucket, the power, for which, is furnished by a 200 horse power Fairbanks-Morse full Deisel type engine, which has since been rated up to 240 horse power and furnishes all the power required for the bucket, screens, washing system, crusher and belt conveyor operations. The bucket is more than able to furnish all of the material that can be handled by the screen and crusher, even when excavating at the 100 foot



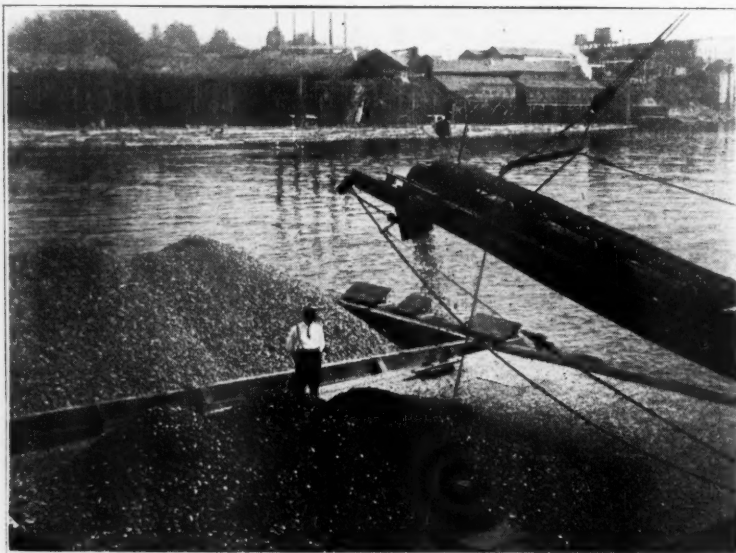
The Dredge of The Willamette Gravel Company

depth. The clam shell bucket discharges into a hopper with a 12 foot square opening, and with a capacity for eight cubic yards of gravel.

A trap in the bottom of the hopper feeds the excavated material to a 30 inch Stephens-Adamson conveyor belt operating on 90 foot centers and inclined 3 inches to the foot so as to raise the material to the proper height to discharge directly into the screen. This screen was designed by the owners for their own material and the processing that they give it. Standard Allis-Chalmers ends and bearings were selected to which were fitted special concentric screens. The inner one is 4 feet in diameter and 16 feet long. Around this is a middle screen 6 feet in diameter and outside of that is the sand jack 7 feet 6 inches in diameter and 8 feet in length. All of the material passing the sand jack is wasted overboard at the rear end of the dredge. Three sizes of gravel are produced but only one at a time; $\frac{1}{4}$ to 1 inch, $\frac{1}{4}$ to 1 $\frac{1}{2}$ inches and $\frac{3}{4}$ to 3 inches. To obtain this grading, the upper end or concentric screens have 1 $\frac{3}{4}$ inch holes for the inner, $\frac{3}{4}$ inch holes for the center and $\frac{1}{4}$ inch holes for the outer screen, or sand jack, while the lower section of the inner screen is changed to the maximum size being produced at the time. The material passing the quarter inch screen is

always wasted while that passing the $\frac{3}{4}$ inch screen is also wasted when $\frac{3}{4}$ to 3 inch material is being produced.

As the sand and gravel are fed to the screen by the conveyor belt, they pass through a stream of water and are further washed as they pass through the screen. The water passes through with the sand. The material retained on the smaller size screen and passing the largest sized screen is discharged on to a 24 inch conveyor belt that carries the finished product out through the side of the dredge and discharges it onto a barge moored alongside. The oversize gravel is discharged onto a grizzly that will pass material under 8 inches in diameter and cause larger rocks to be chuted over the rear end of the dredge. The material passing the grizzly is now crushed by a 48 inch Symons disc crusher to the desired size and discharged to an 18 inch conveyor belt operating on 65 foot centers and inclined to raise the crushed material high enough to discharge it onto the 30 inch conveyor belt first mentioned. This causes the crushed material to be rewashed and sorted again in the original screen in the same manner that the raw material was handled; the fines being wasted, the desired sizes going to the barge and the over-belt that carries the finished product further reduction.



Discharging From The Dredge To Barges

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Water for washing the gravel and crushed rock is furnished by an 8 inch centrifugal pump. An auxiliary gasoline engine of $7\frac{1}{2}$ horsepower is used to furnish compressed air for starting the large 200 horsepower Deisel and to operate a pump to pump the bilge water from the dredge and barges.

The dredge maintains an average output of 300 cubic yards of crushed and sorted material in an eight hour shift and as the dredge is operated by two such shifts at present, it is producing 600 cubic yards daily. This can be increased to 900 yards by operating the third shift.

Practically all of the sand and

gravel used in the construction of Long View, Washington, was furnished by the Portland Gravel Company. Four dealers in that town are getting their entire supply from this source at present.

The Willamette Gravel Company's dredge, Willamette, which is being dismantled, was capable of producing 7,500 cubic yards of graded gravel per month. This dredge is 100 feet long, 32 feet wide and 10 feet deep. Its main power unit is a 150 horsepower Deisel engine. A three drum hoist operated a $1\frac{1}{2}$ yard bucket delivering one load per minute into a metal flume 32 feet long feeding into a revolving screen. This screen, like

FLOW SHEET

Sand and Gravel in place 40 to 100 feet below water surface of Willamette River

Excavated by a $2\frac{1}{2}$ yard Stockton clam shell bucket operated by hoist

Hopper with 12x12 top holding 8 cubic yards

30 inch conveyor belt on Stephens-Adamson conveyor rolls

Washing and sizing screen 16 feet long

Undersize wasted overboard

Desired size to barge on 24 inch conveyor belt

Oversize onto grizzly

Under 8 ins. through 48 ins. Symons disc crusher

Over 8 inches wasted overboard

Crushed material by 18 inch belt back to 30 inch conveyor belt

that of the Portland dredge performed the scalping operations as well as the size back to the Symons crushed for finish sizing. It is 48 inches in diameter by 16 feet in length with a sand jacket on the outside. The material was washed by a stream of water from a centrifugal pump discharging into the flume and screen. Two Ft. Wayne number 10 jaw crushers reduced the oversize material to the required size discharging onto a belt that elevated and discharged the crushed gravel into the flume mentioned above for further washing and sizing. When remodeled, the Willamette dredge will be similar to the Portland dredge described above, having increased output and increased depth to which it can excavate the material.

As stated previously the sand used in Portland comes from sand bars in the bed of the Columbia River. There are many of these bars just above the mouth of the Willamette River in 40 to 80 feet of water. In these deposits the sand has been washed, settled and partially classified by the action of the stream during high water stages. Decomposed organic matter, clays, pumice and other objectionable things found in concrete aggregate have been pretty thoroughly washed away leaving a well graded pure sharp sand of excellent quality.

The Columbia Sand Company, another of the companies of Mr. Puariaea and Mr. Warren, operates a suction dredge in these sand deposits that will load 300 cubic yards of sand into a barge moored alongside in one hour. A 10 inch sand pump operated by a 75 horsepower Fairbanks-Morse Deisel engine sucks up the sand and discharges it onto a flat screen over a metal flume 60 feet long. This flume, which is in reality a settling box, extends out over the barge to be loaded allowing the sand to fall through the bottom of the flume into the barge while the silt overflows the sides and falls into the river.

The Columbia Digger Company operate a dredge and a very efficient unloading plant near Portland. The unloading plant is a bridge crane which may be spotted over any one of a set of bins along the wharf of the Columbia River.

The bridge crane is of steel construction and so designed that the cantilever can be folded up against

the main structure to allow boats with masts to draw alongside the wharf. The unloading crane was built four years ago at a cost of about \$40,000 and it has been in continuous operation ever since. It is operated by one man and equipped with seven motors with a total of 312 horsepower. The crane is 186 feet long with a 94 foot span. The hoisting speed is 200 feet per minute, the trolley speed is 800 feet per minute and the travel speed is 100 feet per minute. It is equipped with a 3 yard Williams bucket and all necessary safety devices.

The dredge is a large scow equipped with a boom derrick and a washing and screening plant. The dredged material is discharged to a hopper and then fed to the screens. The oversize from the screens passes to the crushers and returned to the screens by a bucket elevator. The material is loaded to barges as fast as it comes from the screens. The bunkers are of timber construction. The material is delivered locally by truck and the Columbia Digger Company maintains its own fleet.

Buchanan Company Issues Booklet

An interesting booklet entitled "Experiences of Yesterday Are Guides for Tomorrow" has just been issued by the C. G. Buchanan Company. It deals with the use to which the company's crushers have been put and the testimonials of users.

The foreword of the booklet points out that the primary crusher is the heart of the entire quarry operation and that as every ton of commercial stone must pass through it the whole plant centers around that machine. The foreword goes on to say that secondary crushers in turn control production for their own stages and the primary crusher depends upon the secondaries to take its share of the discharge from the key machine.

The booklet deals with the variety of materials crushed, the types of machines used and the dependability of the crushers. Illustrations show various installation and the types of machines made by the concern. The Buchanan company manufactures both jaw crushers and crushing rolls. A number of companies using Buchanan machinery are listed in the back of the booklet.

Some Quarry Blasting Suggestions

By A. O. Deringer

SOMETIME ago I wrote an article that Pit and Quarry thought good enough to publish. This article treated on shooting with black blasting powder and dynamite combined. If my memory serves me right it stated how they were to be used to produce the best results.

Now some men will tell you this is all bosh. That the two will not mix they being as much alike as gasoline and kerosene, that due to the slowness of the powder you cannot hope to get the desired results and that it is a waste of money to try it out.

We are like the fellow who was afflicted with what was supposed to be an incurable disease, and who after a complete recovery was told by his former doctor that according to all teachings of the medical profession he should have been dead three or four years ago. Well the fellow was hale and hearty and out lived his three score and ten years.

So we claim for this method that although it is contrary to the teachings and beliefs of the powder fraternity it still has chances and will be of help to a good many quarry operators. We had the privilege a few years back to demonstrate this method to a well-known powder representative who was visiting the plant that I had charge of. Fortunately for us we were just loading a large shot by the method under discussion, and I invited him to come to the quarry and see the results of our shot.

During the process of loading he told me that he was afraid we were making a grave mistake in loading our holes as we were; that owing to the slowness of the blasting powder we were likely to have a dual explosion and the latter would be unable to do any execution on account of the fissures that had been opened up by the explosion of the dynamite and allow the gases generated by the powder to escape without exerting any effort on the burden. We however proceeded with our loading as we had it planned and when we were ready to apply the electric current to set off the charge I suspected that he had sort of an "Now we will see what we will see" feeling.

Just as the current was applied we heard and felt a simultaneous explo-

sion—no lagging—no after jolt—as you sometimes experience when using old blasting supplies but a clear distinct explosion that was instantaneous.

I was pleased to note his surprise after we went over the shot which was heaved up about ten feet from its original position and to see that the fragmentation was much better than it would have been had we used the ordinary charge of dynamite.

Now I want to make it plain that I do not recommend this method in all quarries. In a good many it would be folly to even try to work it out. But in such quarries as have fairly stratified ledges it can be worked to good advantage both from an economical and an operating standpoint. Neither would I recommend it unless extraordinary care was exercised in the loading as a haphazard and hit and miss method will only defeat the purpose hoped to be gained.

Nor should it be tried without the use of Cordeau fuse which will give the powder the slightest fraction of a second the start over the dynamite.

But I am getting away from the main thought of this article. However since the foregoing method may be of some help to some operator, and if some one has been benefited thereby I will be happy for only as we help others can we hope to receive help.

The main purpose of this article is to impress upon operators the necessity of giving their blasting problem the same attention they give to the other phases of their operation, viz: the quantity and quality of their product, and the numerous other phases that come under an operators supervision. How many operators have given blasting the earnest study and attention that it should have. They will try to improve every other phase of the operation, install larger and more modern equipment with a view of eliminating labor costs and increasing production, where possibly if they had given this phase of the operation proper study and attention they would have saved themselves a lot of needless expense.

Just what do we understand by giving this part of the operation due study and attention? Well to be brief, just this: How many operators will study their quarry conditions, their

formation, the best way to do their drilling and last but not least just how to load their holes to get the best results. To be sure you won't hit upon the best way to load them the first time you try, neither did Grant take Richmond the first day of his campaign, but by incessant trying and experimenting you will eventually hit upon a method that will prove to you and surprise you the improvement you have made in this important part of your operation.

I have experienced one method that I have found to be very satisfactory and productive of excellent results. That is after you have made a careful survey of the conditions confronting you and have decided upon the amount of explosives required to shatter the burden to meet your requirements you load your shot in such a manner that if it could be cut vertically through each drill hole the whole would have the appearance of a solid mass of explosives from the bottom to a certain distance from the top. By this I mean that each hole be loaded different not necessarily with more explosives but that the explosive and tampering be interchanged so that every part of the shot will have the same amount of energy expended upon it.

In quarries where there is a variation in the stratification where the bottom is heavy and solid and where thick heavy stratas are interspersed throughout the entire height of the ledge I think it will be found that the above method will be a decided advantage over loading each hole the same.

A good many operators may scoff at this plan and it may not be necessary to resort to this practice in a good many instances for I am not a believer in a hard and fast rule in the use of explosives. I think it is incumbent upon every operator to study his own peculiar situation and then after he has established what seems to him a means to bring him the desired results to adhere strictly to them.

New Marion Bulletin

The Marion Steam Shovel Company has published a new bulletin, number 317, entitled "Crowding the Blasting Crew." The bulletin is a pictorial representation of quarry projects and is of particular interest to shovel owners in lime, stone, and cement industries.

Slate Roofs

Although intended primarily for architects, "Slate Roofs" the recently issued booklet of the National Slate Association, has an appeal for the house owner, the contractor and operators in the slate and allied industries. The booklet which came off the press in January of this year is the second of a series published by the association. The first "The Charm of Slate Floors and Walks" was published early last year.

This year's offering is, of course, frankly an attempt to popularize the use of slate for roofing by a thorough explanation of the advantages of the material for roofing purposes, its possibilities and its comparative inexpensiveness. The work starts with a clear explanation of the differences between, standard, textural, graduated and flat slate roofs and then takes up the general characteristics of the material and the great problem of color.

Colored plates are omitted because they are apt to cause confusion since purchasers are sometimes led to believe that the roofing they purchase will be an exact reproduction of the plates. The booklet explains that this is, of course, impossible and that plates can be only an indication of the possibilities. The straightforward way in which this problem is met is to be commended, and the publishers of the book are to be congratulated on their stand.

Architects will be interested in the following section which gives a brief description of each grade of slate, its color characteristics and the locality where it is produced. The section on commercial standards will be of inestimable value to builders and architects.

The more technical side of slate roofing is fully treated in a well illustrated section on "Laying Slate." The diagrams and half tone illustrations make every step of the process clear to any workman. Although much that is said here is probably old to many of the readers of the book, there is probably no other work which will give all the information to be found here and none which has done it so graphically.

Probably the most valuable section of the book from the constructor's point of view is that devoted to sets of standard specifications for all classes of slate roofing.

A Record Breaking Granite Mill

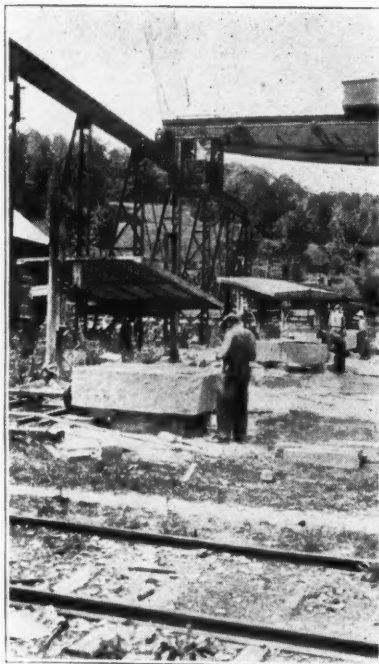
By George Ransom

GRANITE for the widely talked about Cathedral of St. John the Divine in New York City is prepared at the mill of the Woodbury Granite Company at Bethel, Vermont. Doubtless numerous mills in various parts of the country will be involved in this gigantic undertaking before this great structure is completed but at least one of the best known plants in New England is already busy on this job and that fact alone makes the operation of interest.

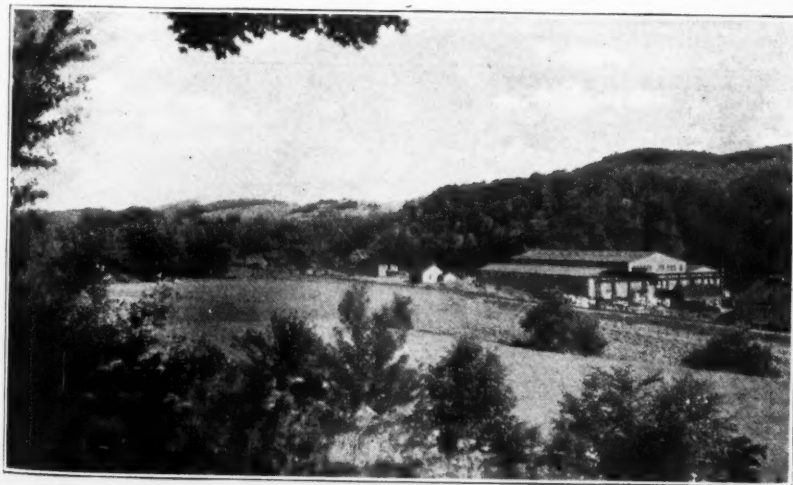
This mill made the record a few years ago of turning out 135,000 cubic feet of stone in 19½ months for the office building of the American Telephone and Telegraph building in New York. Consequently an excursion through a plant having such an achievement to its credit, necessarily will be instructive.

The Woodbury Granite Company has its own quarry four miles from the mill but the stone for the Cathedral of St. John the Divine is being brought from Hall's Quarry on Mount Desert Island, Maine. It is shipped by water to New London, Conn. and thence by rail to Bethel. It is pink in color and known as Somme's Sound granite.

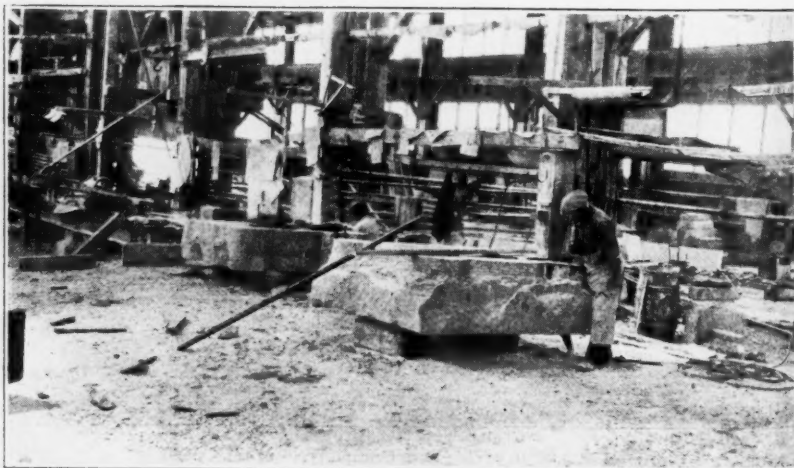
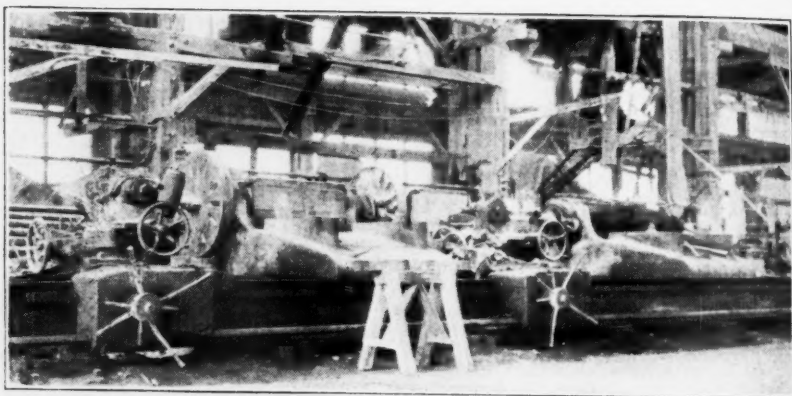
The rough blocks are about 6 tons in weight and between 3 and 4 tons when finished. They are to be used



Outdoor Rough Surfacing Department
for building up the piers, 95 feet high,
which are to support the arches of the



Plant of Woodbury Granite Company, Bethel, Vermont



Above—Central Bay of Mill With 30 Ton Crane
 Center—Second Largest Granite Lathe in Country
 Below—Cutting Blocks For Cathedral of St. John the Divine

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Part of Craneway and Front of Mill

nave. There are to be eight of these piers, four on each side, and each one will be made up of between 50 and 60 stones.

The mill is located in the mountainous valley of the White River. The line of the Central Vermont railroad is also seen passing the mill, as well as the tracks for the outside travelling crane at right angles to the railroad and in front of the mill. The rough blocks of granite, as they arrive on flat cars, are delivered to a siding at the end of the travelling crane. They are picked up by the latter and deposited in the storage space under

the 30-ton Whiting traveling crane or at the outdoor surfacing machines. The surfacing work is carried on out of doors all winter for the better protection of the health of the workmen.

The outside Whiting traveling crane extends across the end of the mill, and surface tracks from the space under this crane run into the building. When a block is to be taken into the mill it is placed on a small car by the crane and pushed through the doorway by hand. It is then taken by one of the inside traveling cranes to whatever location is desired.

It will be seen from the picture



Outside Traveling Crane and Storage

that the mill consists of a large central bay with a smaller one on each side. Each bay has a track entering from the outside, as described, and each one has its own traveling crane. The one in the central bay is a 30-ton Whiting and those on each side are much smaller. It is thus evident that blocks may be transferred from one bay to another by being taken outdoors to the outside travelling crane, running at right angles to the long building, and transferring it by means of the latter to the tracks leading into the appropriate bay.

The blocks of the piers of the cathedral are being shaped by hand. The surfacing of the rough stone is done outdoors, and the block is then brought inside for cutting to proper shape. This is done with the help of sheet metal templets by means of which the stone is marked. Some of the hand cutting is done by a pneumatic chisel.

The mill is equipped with machinery for turning out other kinds of work. In fact it has the second largest lathe in the country, made by the Patch Manufacturing Company, and capable of making columns 28 feet long and 5½ feet in diameter. It is driven by a 50 h.p. induction motor.

There are two other interesting labor saving machines in the east bay. One of these is a boring machine, for hollow steel drills used for ornamental work. This is driven by an individual 15 h.p. induction motor and was made by S. C. Forsyth Machine Company. The other is a Patch carborundum cutter, driven by a 35 h.p. motor.

Van Voorhis Heads Ohio Stone Body

Carl L. Van Voorhis, a civil engineer with a wide reputation throughout the Ohio valley, became chief engineer of the Ohio Crushed Stone Association, January 1. Mr. Van Voorhis was formerly surveyor of Knox county, Ohio and later field engineer of the Ohio Good Roads Federation. More recently he has been secretary of the Ohio Engineering Society.

Mr. Van Voorhis has made a study of road laws, taxation, assessments, construction, maintenance, equipment and other matters having to do with highway improvement. From now on his talents and enthusiasm will be devoted to promoting the virtues of bituminous macadam road pavements.

Austin-Western New Catalog

A comprehensive 96 page catalog has just been issued by the Austin-Western Road Machinery Company. It covers the whole line of Austin and Western graders, rollers, crushers, dump wagons and other machinery.

Although the Austin-Western line consists chiefly of road machinery there is much in their catalog which will be of interest to operators of pits and quarries. There are good photographs and descriptions of the Western revolving screen, for example, which is mounted on a heavy frame ready to be placed on the Western portable bin.

This bin is especially adopted to the small and medium sized plant. This is made in two sizes, 20 yards and 25 yards. The former is a three compartment affair and the latter a four. Several sizes of Austin gyratory crushers are announced of both stationary and portable types. The manufacturers say they are built for crushing extremely hard rock and gravel to small sizes.

Among the special features of the Austin crusher are the automatic lubrication system, the rigid eccentric bearing, the countershaft supported on each side of the pinion. The machine is thoroughly protected from dust and dirt by a dust proof diaphragm over the oil cellar.

The manufacturers claim the Western-Aurora jaw crusher is "different." The crushing movement is unique and exceedingly powerful. It does away with springs and toggles and provides a continuous double stroke movement whereby some part of the jaws is at work all the time. When the top is open to receive new stone the bottom crushes and when the bottom opens the top closes. There is also a slight vertical movement to prevent a dead center.

The company also offers an extremely interesting line of elevators and portable conveyors.

Wilson Enters Consulting Field

Lloyd Wilson, formerly engineer for the Michigan Limestone and Chemical Company and civil engineer for the Solvay Process Company has opened an office for consulting engineering practice at 854 Buhl Building, Detroit, Michigan. He is open for commissions for investigating and report work, designs, quarries, stone crushing and handling plants.

Rehabilitating a Crushed Stone Plant

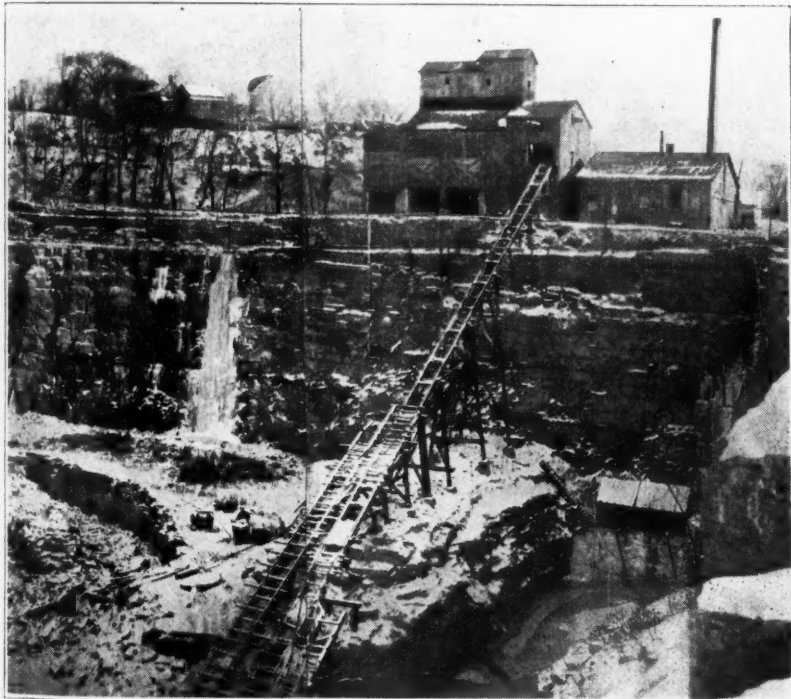
By E. D. Roberts

CONSTRUCTING a new plant does not present nearly as many problems as rehabilitating an old one. In new construction the problem is merely whether the added expense of one installation as compared with another will be justified by greater efficiency, increased output, or better quality of material. In modernizing an old plant we not only have to buy new machinery but must remove the old, and in some cases the cost of this operation is barely covered by the scrap price received for the old equipment. The operator is generally reluctant to throw away a piece of equipment as long as he can get any service out of it at all; and unless he can be shown conclusively that he can make a great saving, he will not replace out-of-date equipment even though he is not satisfied with its operation.

The Wauwautosa Stone Company of Milwaukee, Wisconsin, has been wrestling with this problem for some time

and has recently installed certain machinery recommended by its consulting engineer, Hugo Weimer, which increases both the output and the quality of the product enabling them to have a big percentage of material previously wasted.

This company has been operating a great many years. At first, their product was building stone which was easily cut from the stratified limestone forming the bed of the Menomonee River Valley. This limestone, covered with an average of 10 feet of earth, was uncovered by a Bucyrus steam shovel using a $\frac{3}{4}$ yard bucket which dropped the earth into dump wagons. The earth was used for leveling the lower parts of the tract and for forming a large levee to insure against flooding of the quarry pit during high stages of the Menomonee River. When building stone lost out to reinforced concrete as a building material, the owners naturally turned to the production of crushed stone



Looking Into The Quarry Showing Incline To Plant



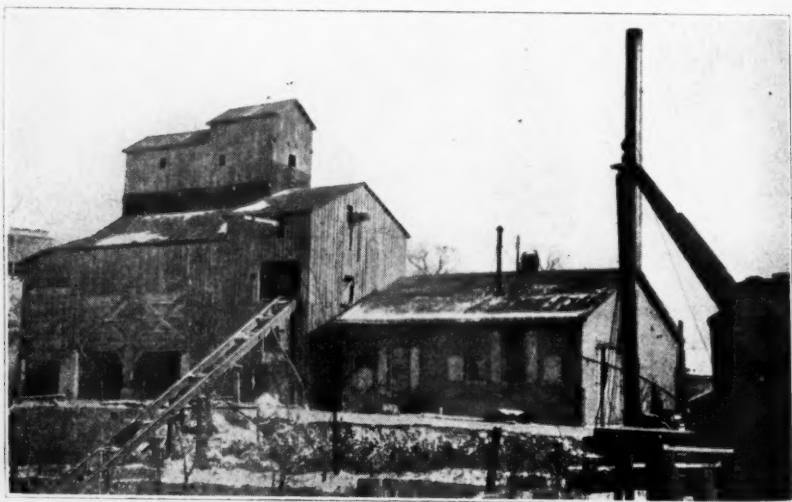
Part of Outside Storage System

and, as their quarry is located nearly in the center of greater Milwaukee, they have been able to find a good market for their product with a comparatively short haul.

The present quarry floor is about 100 feet below the bed of the Menomonee River. An 8 inch Cameron pump and a 6 inch Prescott pump keep the quarry pit free from water drawing their steam from the boilers which furnish power for the crusher plant.

The bedding planes of the stone are very nearly horizontal and in consequence the pit is deepened by taking out a layer over the whole quarry area about fifteen feet in depth before going deeper. A hole is dug in the low corner to the depth of the lift desired. The rock is then worked out

against the face, by drilling with Ingersoll-Rand jackhammer drills and shooting with Grasselli Chemical Company's explosive. The broken rock is hand loaded into $1\frac{1}{2}$ yard steel dump cars. The grade to the quarry floor is just right for aiding the loaded cars toward the foot of the inclined tramway which carries them to the crusher house. A turn-table near the foot of the inclined tramway switches the cars from any of the radiating tracks to the tram line. The tramway is single track but has a switch near the lower end so that descending empties will go down to the right. The descending empty has been lowered by a cable from an Allis-Chalmers friction mine hoist. When the empty car is standing on the level



The Crusher House and Bins

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track at the bottom of the slope, the cable is unhooked and attached to a loaded car waiting on the track alongside. The load is hauled up the incline, which is built on a slope of five feet in twelve, to a point directly over a Number 6 McCully crusher into which the load is dumped.

Discharged from the Number 6 McCully crusher made by the Allis-Chalmers Company it falls directly into a scalping screen which allows the smaller material to fall into a chute leading to and feeding the material onto an inclined continuous bucket elevator. The oversize material is discharged from the scalping screen into a Number 3 Allis-Chalmers crusher which completes the operations. The discharge from the smaller crusher is chuted into the same chute which directs the fine material from the scalper to the bucket elevator. Raised vertically about 60 feet by the inclined continuous bucket elevator the crushed rock is discharged into a 48 inch x 18 feet Allis-Chalmers revolving screen set with a slope of $1\frac{1}{2}$ inches to the foot. Up to this year, the screening was done by a 30 inch screen, but as better results were desired, the new screen was obtained. This new screen makes all of the segregations required with the exception of dust removal. The screen is divided into four equal sections with a sand jacket around the first. The sand jacket passes $\frac{1}{4}$ -inch material and the other sections have $\frac{3}{4}$, $1\frac{1}{2}$, 2 and $2\frac{1}{2}$ -inch holes respectively. This gives dust to $\frac{1}{4}$ to $\frac{3}{4}$, $\frac{3}{4}$ to $1\frac{1}{2}$ to 2, 2 to $2\frac{1}{2}$ and over $2\frac{1}{2}$ inches. All sizes fall directly into hoppers chutes which deliver the different sizes to their respective bins with the exception of the smallest size. Originally, this smallest size was run over a shaker screen to eliminate dust. This shaker screen was later replaced by a sloping screen. Neither of these methods was entirely satisfactory as neither eliminated all the dust. The presence of dust made the product objectionable for concrete use. As a result of the limited market due to dust the company has tens of thousands of yards of fines piled in storage. To eliminate this dust from the fines, they have just installed a Galland-Henning variable motion vibrating screen. The vibrations are furnished by two eccentrically weighed wheels so constructed that the direction of the vibration imparted to the screen can be changed. The screen is set at an angle of fif-

teen degrees but is so positive in the motion imparted to the particles that material can be fed over the screen even though it has been placed horizontally. Power for the operation of this vibrator is furnished by a two horse power General Electric motor operating at 1,800 r.p.m. while the wheels of the vibrator itself revolve at 1,200 r.p.m. The only lubrication required is to fill the housing around the gears with grease. Another feature of this vibrator is the slope at which it is placed. If the power should go off the vibrator's motor, the material will not go on over the screen and perhaps spoil a bin of material. The dust and fines from the vibrator fall into hoppers chutes that lead them directly into the proper bin below.

Slide gates in the bottoms of the bins control the flow of the graded material into trucks spotted underneath. Most of the material is sold directly from the bins but some is stored in the yard when production is ahead of consumption and reclaimed when needed to care for the peak demand for aggregate. Two White trucks with Heil dump bodies haul the excess to the storage pile. These trucks have replaced the horse drawn wagons during the last year. Most of the rock delivery is made by private parties under contract who use Mack trucks equipped with Heil dump bodies.

When being reclaimed from storage, the rock is loaded into the trucks by means of an Atlas portable loader or a Bucyrus $\frac{3}{4}$ yard steam shovel. Compressed air for operating the jack hammer drills is furnished by an Ingersoll-Rand compressor belt driven from the steam engine operating the outer units in the crusher plant, the steam being furnished by 75 h.p. Hoffman-Billing boilers.

The Wauwautosa Stone Company also operates another stone quarry at Forty-ninth and State streets. This quarry is similar to the one described above before it was rehabilitated. Their crushers are Number $7\frac{1}{2}$ and Number 5 Gates crushers.

The Petroleum Electric Company, Tulsa, Oklahoma, are a third organization that have taken on the sale of Climax Engines in the Southwest. P. J. Dasey, Wells Hotel, Tulsa, Oklahoma, is in charge of the Southwestern sales territory and will supervise the sales of these new Climax dealers.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20c each. State number of patent and name of inventor when ordering.

1,569,924. Drag-scraper back-post block. William E. Hale, Fort Washington, Pa., assignor to R. H. Beaumont Co., Philadelphia, Pa.

1,569,925. Drag-scraper. William E. Hale, Fort Washington, Pa., assignor to R. H. Beaumont Co., Philadelphia, Pa.

1,569,930. Tube mill or ball mill. Peter V. A. A. Herbst, Holte, Denmark, assignor to F. L. Smidth & Co., New York, N. Y.

1,570,061. Hoisting mechanism for excavating-cranes. Arthur G. Henricks, Wauwatosa, Wis., assignor to Harnischfeger Corporation, Milwaukee, Wis.

1,570,008. Excavator-crane. Lewis Wehner, Milwaukee, Wis., assignor to Pawling & Harnischfeger Co., West Milwaukee, Wis.

1,570,302. Double-dump skip-hoist. William E. Hale, Fort Washington, Pa., assignor to R. H. Beaumont Co., Philadelphia, Pa.

1,570,303. Skip-bucket carloading apparatus. William E. Hale, Fort Washington, Pa., assignor to R. H. Beaumont Co., Philadelphia, Pa.

1,570,829. Loading-machine. John A. Forsyth, Nemacolin, Pa.

1,570,835. Shovel-machine. Frank M. Hewitt, Oakland, Cal.

1,570,897. Screening device. Curt G. Knoblauch, Park Ridge, Ill.

1,571,377. Girder construction for excavators. George T. Ronk, Des Moines, Iowa, assignor to Spencer Machinery Corporation, Fairfield, Ia.

1,571,782. Dipper-tooth. Charles B. Andrews, High Bridge, N. J., assignor to Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

1,571,784. Skip-hoist bucket. Robert H. Beaumont, Radnor, Pa., assignor to R. H. Beaumont Co., Philadelphia, Pa.

1,571,812. Grinding-mill. Simon Snyder, Muncy, Pa., assignor to Sprout, Waldron & Co., Muncy, Pa.

1,571,817. Concrete-finishing machine. William W. Swhier, Portland, Ind.

1,571,838. Clamshell-dredger bucket. Archibald Hutson, Erie, Pa.

1,572,009. Shovel-machine and loading machine. Charles C. Hansen, Easton, Pa., assignor to Ingersoll-Rand Co., Jersey City, N. J.

1,572,066. Mining-machine. Russell E. Booker, Windber, Pa.

1,572,067. Mine-drill. Russell E. Booker, Windber, Pa.

1,572,177. Cable drive for shovels. Raymond A. Beckwith, Milwaukee, Wis., assignor to Koehring Co., Milwaukee, Wis.

1,472,228. Fairlead for drag-line excavators. Paul Burke, Green Bay, Wis., assignor to Northwest Engineering Co., Green Bay, Wis.

1,572,229. Power system. Paul Burke, Green Bay, Wis., assignor to Northwest Engineering Co., Green Bay, Wis.

1,527,230. Servo mechanism. Paul Burke, Green Bay, Wis., assignor to Northwest Engineering Co., Green Bay, Wis.

1,572,556. Mining-machine. Richard Peale, St. Benedict, Pa., assignor to Rembrandt Peale, St. Benedict, Pa.

1,567,320. Machine for handling and transporting loose materials. Kenneth Davis, St. Benedict, Pa., assignor to Rembrandt Peale, same place.

1,567,385. Concrete - distributing apparatus. Alexander B. Reed, Pittsburgh, Pa.

1,567,386. Concrete - distributing apparatus. Alexander B. Reed, Pittsburgh, Pa.

1,567,496. Drag-line scraper. John J. Fitzgerald, Stapleton, N. Y.

1,568,699. Mechanical shovel. Erick von Mehren, Duluth, Minn., assignor to Hoar Shovel Co., same place.

1,568,752. Ball-grinding mill. Povl T. Lindhard, Brooklyn, N. Y., assignor to F. L. Smidth & Co., New York, N. Y.

1,568,792. Screen. Randall P. Akins, John W. Bucher, and Frederick D. Gross, Denver, Colo.

1,569,031. Power shovel. John D. Rauch, Lima, Ohio, assignor to Ohio Steam Shovel Co., same place.

1,569,510. Tunneling-machine. Frederick C. Lidke, New York, N. Y.

1,569,542. Rock-drilling mechanism. Elmer G. Gartin, Claremont, N. H., assignor to Sullivan Machinery Co., same place.

Producing a Black Rock Economically

By F. A. Westbrook

DESPITE its name the Jointa Lime Company of Glens Falls, New York, is a crushed stone operation. The lime business of the concern was sold to the F. W. Wait Lime Company which has an adjoining quarry and produces an extremely high grade chemical lime under the Jointa name. This operation has been described previously in Pit and Quarry.

The crushed stone operations of the Jointa Company have several distinctive features resulting from the conditions under which the work is carried on. The stone is a silicious rock, almost black and very much like the high calcium black marble of the Wait quarry used for making Jointa Lime. It is the same kind of rock used by the Glens Falls Portland Cement Company and in its smaller sizes is in great demand for state road work because of its remarkable bonding qualities.

The quarry is shallow and covers a large surface. The rock now being used underlies the black marble formerly used for Jointa Lime but which has now been worked out. Thus there is no surface to be stripped.

The crushing machinery is located at one end of the quarry and adjacent to the barge canal. The rock is brought up on small dump cars running on narrow gauge tracks from

the seat of operations in the quarry to the base of an incline to the crushers. There is a slight grade to this track which favors the loaded cars and they are pulled by a single horse as far as the incline. From there to the crusher they are pulled by a steel cable and hoisting engine.

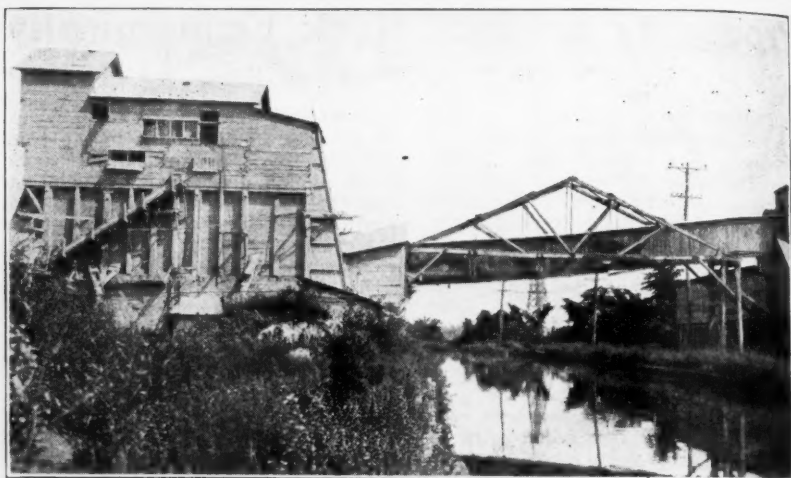
Blasting is done at frequent intervals with small charges of dynamite. Heavy charges are avoided because the quarry is in city limits. This does away with elaborate drilling operations and permits only the use of Denver jack-hammers. The 40 per cent dynamite used shatters the rock into small pieces so practically no secondary blasting is necessary and no jaw crusher. The loosened pieces are loaded into the dump cars by a Marion (non-caterpillar) steam shovel, and taken to gyratory crushers.

There are two gyratory crushers, a number 6 and number 4 Allis-Chalmers. When the stone is dumped out of the cars it drops into the number 6 crusher and from there is carried by a bucket conveyor to the number 4 crusher and from there is into a pit and is carried by a bucket elevator to the screen which sorts it into various sizes, dust, $\frac{3}{8}$, $1\frac{1}{4}$, $2\frac{1}{2}$ and 3 inch; and drops each size into appropriate bins.

Practically none of the rock needs to be recrushed. This is different from



Incline Leading From Quarry to Crusher; Loads Are Pulled By Cable



Bridge For Conveyors From Crushing Plant to Railroad Bins

crushing trap rock. The latter is so hard that it comes off in large pieces when blasted and requires much secondary blasting and a jaw crusher in addition to break up the resulting pieces. Even after that a great deal of recrushing is necessary. The crushing of this black silicious rock is more or less midway between crushing cobbles, which involves no blasting and only one crusher, and trap rock entailing heavy blasting and several stages of crushing. Perhaps the outstanding accomplishment at this plant from the labor saving standpoint is

the way in which provision has been made to load the finished product on to trucks, canal boats, or railroad cars.

As stated, the crushing plant is located on the bank of the barge canal and across the canal is the railroad siding. As the stone comes through the screen it drops into bins and under these is a belt conveyor which extends all the way across the canal to storage bins adjacent to the railroad tracks. Thus by opening the chute at the bottom of any bin the crushed stone drops onto the conveyor



Drilling Rock With Jack Hammers

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and is carried to the loading point for trucks, canal boats or the railroad bins as described.

The railroad bins are, as a general thing, kept filled and they are located over the tracks so that it is only necessary to back the cars under them in

order to load them. The same is true of the canal boats and trucks although there are no bins over the canal—there is simply an opening on the under side of the bridge to which the material is carried on the belt conveyor.

Producing Asphaltic Limestone

ASPHALTIC limestone is the material used throughout Europe for the standard asphalt street, but this product is little known in this country because until recently it was not known to occur anywhere in the United States in commercial way except in western Texas at Uvalde. In 1921 Mr. C. W. Ashcraft of Florence, Alabama, returned from overseas' service with the Army, having observed the use of this material for street paving and highway purposes over there. He knew of a deposit of black rock in the western part of Colbert County, Alabama, and immediately began investigations. Chemical and physical analyses proved this rock to be identical with the European and Texas materials except that it does not carry as high a percentage of bitumen, although the bitumen contained is of unusual ductility and the limestone is a very tough oolite.

In 1922 Mr. Ashcraft had carried his studies to a point where he believed the stone would produce an excellent pavement, and in order to have it used in comparison with the Uvalde stone he shipped a carload to Dallas, Texas, where it was laid by Uvalde Paving Company on McKinney avenue. It has seen hard service now since 1922 and is still showing up in fine condition with no appreciable wear apparent.

In 1923 six blocks in Florence, Alabama, were paved with this material by the cold process and this is showing up in excellent form without appreciable wear.

In 1924 the Uvalde Paving Company of Dallas, Texas, entered Alabama using this limestone exclusively and paved during the year about seventy-five city blocks. In 1925 the Uvalde Paving Company completed extensive contracts for the Alabama Highway Department and also extensive contracts in both Sheffield and Mobile, Alabama.

In all these places this material has shown up in the best of form and engineers say they have never seen any better pavement of any material

anywhere. This deposit and the pavements from it have attracted nationwide attention and geologists and engineers from the entire country have journeyed to this section of Alabama to inspect both the geological occurrence and pavements produced from the product.

The Alabama Rock Asphalt Company owns about 700 acres of land with the ledge occurring almost continuously on it to a thickness of about an average of 12 feet. There is an average of about 7 per cent of asphalt which permeates the limestone and the permeation is quite uniform. The asphalt appears to be somewhat harder near the surface than at the bottom of the ledge. However, it is thought that when the quarrying operations have progressed far enough for the deposit to carry a real overburden this condition will probably not hold. The quarrying operation so far has been where there was from nothing to only two or three feet of overburden.

The quarrying operation is carried on with compressed air and jackhammer drills, and while the rock is quite tough it does not gum the drills. In blasting, the rock does not break in any definite line of cleavage.

Up to this time the company has not put in a crusher but has sledged the large pieces to the size of one man stone. The opening is about two miles from the main line of the Southern Railway at Margerum, Alabama, and the product has been hauled in trucks for loading at Margerum. However, the company has taken advantage of the winter period to put in a standard gauge railroad spur to their property and also have arranged to put in a crusher to reduce the stone from quarry-run to a uniform five inch run. In 1922 the output was 1 carload; in 1923, 23 cars; in 1924, 69; in 1925, 429 cars.

The company has been very aggressive in placing its material before the paving public and indications are that the year 1926 will show a large increase in their output.

Curtis Portable Compressor

A portable compressor is built by the Curtis Pneumatic Machinery Company especially to operate as a unit with a Fordson tractor. The unit differs from the ordinary portable of the trailer type, by its ability to move quickly to points where air is needed, by its own power.

Long life at minimum maintenance cost is the natural result of the generous proportions of this rugged compressor, kept well lubricated by the Curtis automatic sight feed system and operated at moderate speed.

The compressor is driven by a belt from the tractor and its relative speed is fixed by the sizes of tractor take-off pulley and compressor flywheel. The compressor speed may be somewhat increased or decreased by an adjustment of this governor. The tractor governor is of the centrifugal type and it is necessary to hold down the speed when the compressor is running idle. If desired, a governor cross connection can be arranged to slow down both engine and compressor to idling speed when air is not needed.

The tractor may be moved about in any of the four speeds provided by the usual transmission, and when fitted with rubber tired wheels it can be run over city streets at speeds up to 15 miles per hour. The wheels of the portable compressor connect by a rod extending forward to and bolted on the steering arm of the tractor so that the combined unit is controlled by the regular tractor steering wheel.

The compressor is 6x6 inch double cylinder, single acting, water cooled with controlled splash lubrication and sight feed regulation, speed 450 to 550 r.p.m. The cooling system is complete and separate from the tractor, with thermo-syphon circulation. It has extra large piping and special radiator cooled by fan flywheel. The air receiver is 24x30 inches and equipped with safety valve and gauge. It is mounted on a two-wheel trailer of structural steel with suitable steel connections for coupling to tractor. It has a standard Fordson type axle, and the steering knuckles connect with the tractor steering wheel. Built-in adjustable legs provide steady support when compressor is operating and permit one man to easily connect or disconnect. There is a flexible belt connection at suitable tension provided

by spring idler belt tightener with flexible roller bearings. Belt guard and endless drive belt are standard equipment and a horizontal adjustment is provided for variation in length.

Buys Sparta Drill Works

The Burkhardt Company of Kiel, Wisconsin, has purchased the patents, stock and good will and other assets of the Sparta Iron Works Company. As soon as the new concern took over the old it announced it would not rush headlong into the manufacture of new rigs but would content itself for the time being with servicing the existing machines and supplying tools.

The men in the Burkhardt company have been in the well drive shoe and tool business for twenty years. As soon as possible they will begin the manufacture of new rigs. This will probably be within the next few weeks. They will make Sparta drills as they have always been made believing that these drills have proven their worth to the trade.

The Sparta drills are designed for operators wanting a medium priced machine which is both highly efficient and modern in every respect. The outfits are light, considering their capacity and the portable machines are easily moved. Notwithstanding their lightness, the manufacturers claim they are strong, durable, simple in construction and operation and extremely rapid drillers.

The manufacturers believe that the fact can not be contested that the speed of a drilling machine either of the walking beam or spudding class, depends largely on the weight of the tools, the rapidity with which they are dropped, the horsepower of the engine and the regulating device which controls the speed of the engine.

The weight of the tools, naturally, will be regulated by the size of the machine and the size of the bit used. The number of strokes a minute will vary from 40 to 75 depending on the depth of the hole and the length of the stroke.

When running at the highest rate, the manufacturers say, the Sparta is regular and smooth without vibration and racking. The machines can be furnished with either steam, gas or electric power.

Compressed Air and Air Compressors

By C. H. Sonntag

Part II.

Two Stage Compression

The temperature attained during compression rises rapidly with higher delivery pressures, and so the possible power saving when working at these pressures becomes important. Suppose that we desire to compress from an initial pressure P_1 to a discharge pressure P_2 as in Figure 2. It can be done in one stage along the curve CDG, and the horsepower will be represented by the area BCGI. But we may, if we wish, compress only to an intermediate point, as P_3 , remove the air from the cylinder, cool it to the original temperature, and then finish the compression in another cylinder. Its volume at the moment of completion of the first operation is denoted by the line FD. When the air is cooled, it will diminish in volume by an amount DE. Further compression can proceed in a smaller cylinder along the curve EH, and the total horsepower required will be proportional to the area BCDEHI, which is manifestly less than the area BCDGI, and the area EDGH corresponds to the power saved by two-stage compression with complete cooling between the stages. In addition, the temperature at the end of the second stage is lower, making lubrication easier and more certain, and rendering overheating of the discharge valves less likely.

The pressure at which the first cylinder should discharge to the intercooler, in other words, the pressure in the intercooler, should be such that the work done in the two cylinders is equal, because at this point the total work of compression is a minimum.

This pressure is given by the equation $P_3 = \sqrt{P_1 P_2}$, all expressed in absolute pressure.

Table III (b) gives some of these values for the more common pressures. Assuming that the machine is correctly designed for the work it is to do, any great departure of the inter-cooler pressure from the tabulated value when working to capacity would indicate leaky valves, broken piston rings, poor cooling or some other abnormal condition that should be investigated. The table also shows the percentage of one stage power saved by using two stages.

Up to 60 or 70 pounds gauge pressure, single stage compression is very satisfactory, and has the advantage of simplicity and low first cost. It can be carried to 100 pounds, but the temperature at the end of the stroke is quite high, and may cause overheating of the valves or charring of the oil on them, leading to carbon deposits and leakage. This will be understood when it is stated that the instantaneous temperature of air originally at 32° F. is about 460° F. at the end of adiabatic compression to 100 pounds gauge. With small machines having large cooling surface for the work they do, single stage operation will give good service, but if the machine is of any size and is to deliver at pressures materially above 60 pounds, two stage compression should be used. Quarry and mining operations commonly need air at 90 or 100 pounds pressure, so that

(b)—Union Steam Pump Co.

TABLE III.

Intercooler Pressure and Cylinder Ratio for Two Stage Compression Intercooling Back to Initial Temperature, but Jacket Cooling Not Considered

Gauge Press. lbs.	Absolute pressure lbs.	Number of Atmospheres	Correct ratio cylinder volumes	Intercooler gauge pressure	Saving of one stage power
50	64.7	4.40	2.10	16.2	10.9
60	74.7	5.08	2.25	18.4	11.3
70	84.7	5.76	2.40	20.6	12.3
80	94.7	6.44	2.54	22.7	13.8
90	104.7	7.12	2.67	24.5	14.2
100	114.7	7.80	2.79	26.3	15.0
110	124.7	8.48	2.91	28.1	15.2
120	134.7	9.16	3.03	29.8	15.6
130	144.7	9.84	3.14	31.5	16.3

compressors in these industries should have compound air ends.

In liquefying carbonic acid gas for shipment in drums to soda fountains, or in making liquid air for the separation of commercial oxygen for welding, very high pressures are used, and these are reached in three or four stages with complete cooling after each stage. These pressures are not used in quarry work, and so will not be further considered.

Capacity of a Compressor.

In selecting a compressor to handle a given amount of air the purchaser is mainly interested in the displacement, the volumetric efficiency and the effect of altitude.

Displacement.

This may be simply defined as the volume swept out in unit time, usually one minute, by the net area of the piston, excluding the rod. In multi-stage machines the displacement is figured on the low pressure cylinder, since it determines the volume of air taken into the machine. It follows that if a compressor offered for a certain rating has small cylinders, it must run at high speed, and possibly the travel of the piston in feet per minute may exceed the limits of good practice. If a machine is offered to run with a piston speed greater than 650 feet per minute its record in earlier installations should be looked up.

Volumetric Efficiency.

This is the ratio of the amount of free air actually compressed in a given time to the piston displacement during that time. This is usually determined from the indicator diagram, since the actual measurement of the air would be both difficult and costly.

It is always less than unity because of the effect of clearance, the inertia of the inlet valves and the friction through their ports and the suction piping. Clearance is the space in the end of the cylinder that is not filled by the piston at the end of its stroke. Air compressed in this space expands behind the piston as it recedes, and fresh air cannot enter until the pressure of the clearance air has been reduced to atmospheric. In small machines the clearance may be as much as three per cent, but in large ones it has been reduced by careful design to less than 1 per cent. Its effect on the volumetric efficiency is greater than these percentages, since the clearance is filled with air at high pressure, and at 100 pounds gauge will expand to about seven times its volume before fresh air can enter. The volumetric efficiency of commercial machines varies from 75 per cent to 95 per cent according to the clearance and other conditions.

Effect of Altitude.

A cubic foot of air weighs less at a high altitude than at sea-level, and so a compressor so situated will take in a less weight of air at each stroke. The atmospheric or inlet pressure, which may be considered to help the work of compression, being lower, more power will be needed to make up the difference. Also, the clearance air in expanding to atmospheric pressure will occupy a larger part of the cylinder volume, so that volumetric efficiency is lessened. For these reasons a compressor to be used at a high altitude should have the air cylinders (and steam cylinders also, if used) proportioned for the altitude in question.

TABLE IV.

Effect of Altitude.

Volumetric and horsepower coefficients for two-stage air compression.

Altitude, Feet	Terminal Gauge pressure, Lbs. per sq. in.											
	80	90	100	120	Barom. press. lbs. per sq. in.	H. P. Coeff.	Volume Coeff.	H. P. Coeff.	Volume Coeff.	H. P. Coeff.	Volume Coeff.	H. P. Coeff.
Sea level	14.72	1.00	1.00	1.00	14.72	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1,000	14.17	.98	.97	.98	14.17	.98	.97	.98	.97	.98	.97	.97
2,000	13.64	.96	.94	.96	13.64	.96	.94	.96	.94	.96	.93	.93
3,000	13.13	.95	.91	.94	13.13	.95	.91	.94	.91	.94	.90	.90
4,000	12.64	.93	.88	.93	12.64	.93	.88	.92	.88	.92	.87	.87
5,000	12.17	.91	.85	.91	12.17	.91	.85	.91	.85	.90	.84	.84
6,000	11.71	.89	.82	.89	11.71	.89	.82	.89	.82	.88	.82	.82
7,000	11.27	.88	.79	.87	11.27	.88	.79	.87	.79	.86	.79	.79
8,000	10.85	.86	.77	.85	10.85	.86	.77	.85	.76	.85	.76	.76
9,000	10.45	.84	.74	.84	10.45	.84	.74	.83	.74	.83	.73	.73
10,000	10.06	.83	.72	.82	10.06	.83	.72	.82	.71	.81	.71	.71
11,000	9.69	.81	.70	.80	9.69	.81	.70	.80	.69	.79	.68	.68
12,000	9.33	.79	.67	.79	9.33	.79	.67	.78	.67	.78	.66	.66

Table IV (c) shows the effect of altitude on the capacity and horsepower. The figures indicate that at a height of 10,000 feet, not unusual in mining operations, the power is 82 per cent of that at sea-level, while the volumetric efficiency is only 71 per cent, which means that air cylinder capacity must be increased by about 40 per cent.

Transmission of Compressed Air.

Like steam or electricity, compressed air is of no value at its source, and must be transported in some way to the place where it is to be used. As with every other form of power transmission, certain losses are inherent in the process, but their magnitude is controllable to a certain extent, depending on how much money we are willing to spend to minimize them. However, it is true with this as with other forms of power transmission that the cost of bringing the loss to a very low figure is greater than the value of the power saved by so doing, so that every transmission is a compromise between first cost and energy loss. As with other methods of conveying power, it has been found that where the use is nearly continuous and nearly up to the capacity of the source, one is warranted in spending more money to conserve the loss than if the use were intermittent and low in demand. In the case of compressed air this means that in permanent in-

stallations that will be in daily use to full capacity for a number of years larger piping will be justified than for a temporary job.

Pipe Friction.

The loss in pressure when air flows through a pipe is caused by the friction of the air on the inside surface of the pipe and, at high velocities, by the friction of the particles of air on each other due to the turbulence of flow. Mathematical formulae have been worked out for calculating this loss, but these are cumbersome to use, and it is much easier to get this information from a table based on experiment as well as on theory. Table V (d) covers all conditions likely to be encountered in practice. The loss in pressure is in pounds per square inch per thousand feet of pipe, and the loss for any other length will be in proportion. For instance, the loss in 750 feet will be $\frac{3}{4}$ of the table value, or for 2,500 feet will be $2\frac{1}{2}$ times that shown.

Friction Through Valves and Fittings.

The loss in pressure resulting from flow through an elbow or tee has been found to be about $\frac{2}{3}$ of the loss through a globe valve of the same size. Table VI (d) gives the loss through the fittings, and that through the globe valves may be found by multiplying the tabular values by three halves.

The loss is expressed as the length of straight pipe of the same size that will give the same drop. The loss

(c)—Sullivan Machinery Co., Chicago.

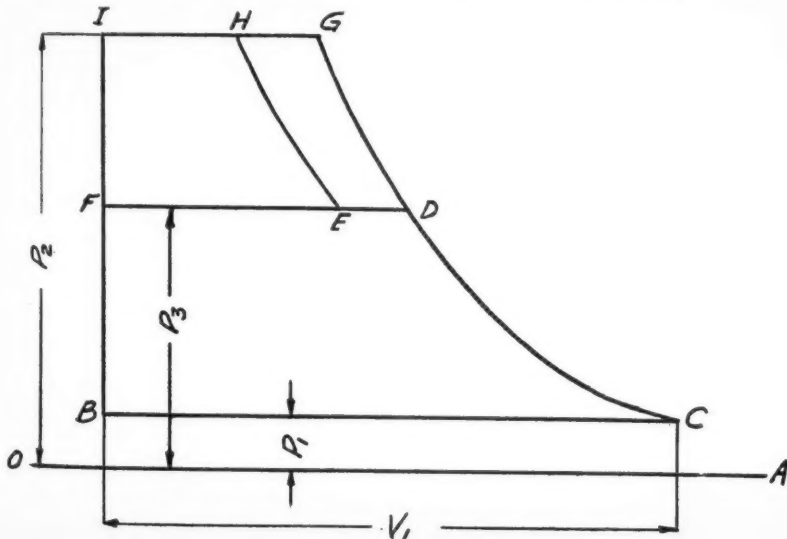


Figure 2

TABLE VI

Diameter of pipe	1	1½	2	2½	3	3½	4	5	6	inches
Additional length	2	3	5	7	9	11	13	19	24	feet
	7	8	10	12	15	18	20	22	24	inches
	30	35	47	59	77	96	108	120	134	feet

TABLE VII

DISCHARGE OF AIR THROUGH AN ORIFICE IN CUBIC FEET OF FREE AIR PER MINUTE

Flowing From a Round Hole Having Rounded Inner Edges, Into the Atmosphere

For a round hole having sharp inner edges the quantity will be approximately 70% of tabulated figures.

Receiver Gauge Pressure	¼ inch	⅜ inch	½ inch	⅝ inch	¾ inch	1 inch	1¼ inch	1½ inch	2 inch
Pounds	Discharge in Cubic Feet of Free Air Per Minute	Discharge in Cubic Feet of Free Air Per Minute	Discharge in Cubic Feet of Free Air Per Minute	Discharge in Cubic Feet of Free Air Per Minute	Discharge in Cubic Feet of Free Air Per Minute	Discharge in Cubic Feet of Free Air Per Minute	Discharge in Cubic Feet of Free Air Per Minute	Discharge in Cubic Feet of Free Air Per Minute	Discharge in Cubic Feet of Free Air Per Minute
2	.038	.153	.647	2.435	9.74	21.95	39.	61.	87.60
5	.0597	.242	.965	3.86	15.40	34.60	61.60	96.50	133.
10	.0842	.342	1.36	5.45	21.8	49.	87.	136.	196.
15	.103	.418	1.67	6.65	26.70	60.	107.	167.	240.
20	.119	.485	1.93	7.7	30.8	69.	123.	193.	277.
25	.133	.54	2.16	8.6	34.5	77.	138.	216.	310.
30	.156	.632	2.52	10.	40.	90.	161.	252.	362.
35	.173	.71	2.80	11.2	44.7	100.	179.	280.	400.
40	.19	.77	3.07	12.27	49.09	110.45	196.35	306.80	441.79
45	.208	.843	3.36	13.4	53.8	121.	215.	336.	482.
50	.225	.914	3.64	14.50	58.2	130.	232.	364.	522.
60	.26	1.05	4.2	16.8	67.	151.	268.	420.	604.
70	.295	1.19	4.76	19.	76.	171.	304.	476.	685.
80	.33	1.33	5.32	21.2	85.	191.	340.	532.	765.
90	.364	1.47	5.87	23.50	94.	211.	376.	587.	843.
100	.40	1.61	6.45	25.8	103.	231.	412.	645.	925.
125	.486	1.97	7.85	31.4	125.	282.	502.	785.	1100.

TABLE V.
Loss of Pressure by Friction in Pipe

Delivery in Cu. Ft. of Compressed Air per Min.	Equiv. Cu. Ft. of Free Air per Min.	Size of Pipe, Inches															
		1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	4 1/2	5	6	7	8	9	10	12 1/4
Loss of Pressure, in Pounds, by Friction in 1000 Feet Lengths of Pipe																	
At 80 Pounds Gauge																	
7.74	50	14.31	3.96	1.53	.33	.10	.03	.01	.....	.....	.....	.....	.....	.....	.....	.....	.....
11.3	75	.....	8.46	3.26	.71	.21	.08	.03	.01	.....	.....	.....	.....	.....	.....	.....	.....
15.2	100	.....	15.31	5.92	1.28	.39	.14	.06	.03	.02	.01	.....	.....	.....	.....	.....	.....
19.4	125	.....	.....	9.64	2.09	.64	.24	.11	.05	.03	.01	.....	.....	.....	.....	.....	.....
23.2	150	.....	.....	13.70	2.99	.91	.34	.15	.07	.04	.02	.....	.....	.....	.....	.....	.....
27.2	175	.....	.....	.....	4.09	1.25	.47	.21	.10	.06	.03	.01	.....	.....	.....	.....	.....
31.0	200	.....	.....	.....	5.34	1.63	.61	.27	.13	.07	.04	.01	.....	.....	.....	.....	.....
38.7	250	.....	.....	.....	8.32	2.54	.96	.43	.21	.12	.07	.02	.01	.....	.....	.....	.....
46.5	300	.....	.....	.....	12.01	3.67	1.38	.62	.30	.17	.09	.03	.01	.....	.....	.....	.....
54.2	350	.....	.....	.....	.....	4.99	1.83	.84	.41	.23	.13	.05	.02	.01	.....	.....	.....
62.0	400	.....	.....	.....	.....	6.53	2.45	1.11	.54	.30	.17	.06	.03	.01	.....	.....	.....
69.7	450	.....	.....	.....	.....	8.25	3.13	1.40	.69	.38	.22	.08	.04	.01	.....	.....	.....
77.4	500	.....	.....	.....	.....	10.81	3.83	1.79	.85	.47	.27	.10	.05	.02	.01	.....	.....
92.9	600	.....	.....	.....	.....	5.61	2.46	1.22	.68	.39	.15	.06	.03	.02	.01	.....	.....
108.2	700	.....	.....	.....	.....	7.46	3.37	1.66	.92	.53	.20	.09	.04	.02	.01	.....	.....
124.0	800	.....	.....	.....	.....	9.88	4.42	2.18	1.19	.69	.27	.12	.06	.03	.02	.01	.....
139.5	900	.....	.....	.....	.....	.....	5.61	2.77	1.54	.88	.34	.15	.08	.04	.02	.01	.....
152	1000	.....	.....	.....	.....	.....	6.64	3.29	1.82	1.04	.40	.18	.09	.05	.03	.01	.....
232	1500	.....	.....	.....	.....	.....	15.41	7.62	4.24	2.43	.95	.43	.22	.12	.06	.02	.01
310	2000	.....	.....	.....	.....	.....	.....	13.62	7.58	4.32	1.69	.77	.39	.21	.12	.04	.01
387	2500	.....	.....	.....	.....	.....	.....	.....	11.79	6.88	2.64	1.19	.69	.33	.19	.07	.03
465	3000	.....	.....	.....	.....	.....	.....	.....	.....	9.72	3.79	1.73	.87	.48	.28	.11	.05
542	3500	.....	.....	.....	.....	.....	.....	.....	.....	13.25	5.27	2.35	1.19	.65	.37	.15	.06
620	4000	.....	.....	.....	.....	.....	.....	.....	.....	.....	6.78	3.07	1.55	.85	.49	.19	.09
697	4500	.....	.....	.....	.....	.....	.....	.....	.....	.....	8.54	3.89	1.97	1.08	.66	.25	.11
774	5000	.....	.....	.....	.....	.....	.....	.....	.....	.....	10.55	4.79	2.46	1.33	.77	.30	.14
At 100 Pounds Gauge																	
6.41	50	11.89	3.29	1.28	.27	.08	.03	.01	.....	.....	.....	.....	.....	.....	.....	.....	.....
9.61	75	.....	7.42	2.87	.62	.19	.07	.03	.01	.....	.....	.....	.....	.....	.....	.....	.....
12.81	100	.....	13.20	5.11	1.15	.34	.12	.05	.02	.01	.....	.....	.....	.....	.....	.....	.....
15.81	125	.....	.....	7.75	1.68	.52	.19	.08	.04	.02	.01	.....	.....	.....	.....	.....	.....
19.22	150	.....	.....	11.42	2.48	.75	.29	.13	.06	.03	.02	.01	.....	.....	.....	.....	.....
22.39	175	.....	.....	.....	3.38	1.03	.39	.17	.09	.04	.03	.01	.....	.....	.....	.....	.....
25.62	200	.....	.....	.....	4.43	1.36	.51	.23	.12	.06	.04	.02	.01	.....	.....	.....	.....
31.62	250	.....	.....	.....	6.72	2.06	.77	.35	.17	.09	.05	.02	.01	.....	.....	.....	.....
38.44	300	.....	.....	.....	9.95	3.04	1.14	.51	.25	.14	.08	.03	.01	.....	.....	.....	.....
44.78	350	.....	.....	.....	13.41	4.11	1.54	.69	.34	.19	.11	.04	.02	.01	.....	.....	.....
51.24	400	.....	.....	.....	.....	5.40	2.06	.92	.45	.25	.15	.05	.03	.01	.....	.....	.....
57.65	450	.....	.....	.....	.....	6.85	2.57	1.16	.57	.32	.18	.07	.03	.02	.01	.....	.....
63.24	500	.....	.....	.....	.....	8.21	3.03	1.39	.68	.38	.22	.08	.04	.02	.01	.....	.....
76.88	600	.....	.....	.....	.....	12.21	4.58	2.14	1.63	.57	.33	.12	.05	.03	.02	.01	.....
89.56	700	.....	.....	.....	.....	6.19	2.79	1.38	.77	.44	.17	.07	.04	.02	.01	.....	.....
102.5	800	.....	.....	.....	.....	8.13	3.67	1.81	1.00	.57	.22	.10	.05	.03	.02	.01	.....
115.3	900	.....	.....	.....	.....	10.23	4.64	2.29	1.27	.76	.28	.13	.06	.04	.02	.01	.....
126.5	1000	.....	.....	.....	.....	12.59	5.00	2.76	1.23	.88	.34	.16	.08	.04	.03	.01	.....
192.2	1500	.....	.....	.....	.....	.....	12.81	6.63	3.51	2.03	.78	.36	.18	.09	.05	.02	.01
256.2	2000	.....	.....	.....	.....	.....	.....	11.35	6.61	3.62	1.41	.67	.33	.18	.10	.04	.02
316.2	2500	.....	.....	.....	.....	.....	.....	.....	9.50	5.51	2.14	.97	.49	.27	.16	.06	.03
384.4	3000	.....	.....	.....	.....	.....	.....	.....	14.04	8.11	3.16	1.44	.76	.39	.23	.19	.04
447.8	3500	.....	.....	.....	.....	.....	.....	.....	.....	10.95	4.26	1.93	.98	.53	.31	.12	.05
512.4	4000	.....	.....	.....	.....	.....	.....	.....	.....	14.48	5.59	2.55	1.30	.72	.41	.16	.07
576.5	4500	.....	.....	.....	.....	.....	.....	.....	.....	.....	7.04	3.22	1.84	.89	.52	.21	.09
632.4	5000	.....	.....	.....	.....	.....	.....	.....	.....	.....	8.51	3.88	1.93	1.07	.63	.25	.11
At 125 Pounds Gauge																	
5.26	50	9.88	2.70	1.05	.23	.07	.03	.01	.....	.....	.....	.....	.....	.....	.....	.....	.....
7.89	75	.....	22.20	6.07	2.37	.51	.16	.06	.03	.01	.....	.....	.....	.....	.....	.....	.....
10.51	100	.....	39.50	10.82	4.22	.91	.28	.10	.05	.02	.01	.....	.....	.....	.....	.....	.....
13.15	125	.....	.....	19.88	6.58	1.42	.43	.17	.07	.04	.02	.01	.....	.....	.....	.....	.....
15.79	150	.....	.....	.....	24.33	9.47	2.04	.83	.23	.11	.05	.03	.02	.01	.....	.....	.....
18.41	175	.....	.....	.....	33.05	12.90	2.78	.85	.32	.14	.07	.04	.02	.01	.....	.....	.....
21.05	200	.....	.....	.....	.....	16.84	3.63	1.11	.42	.19	.09	.05	.03	.01	.....	.....	.....
26.30	250	.....	.....	.....	.....	26.30	5.63	1.73	.65	.29	.15	.08	.05	.02	.01	.....	.....
31.58	300	.....	.....	.....	.....	37.90	8.18	2.51	.94	.42	.21	.12	.07	.03	.01	.....	.....
36.81	350	.....	.....	.....	.....	.....	11.08	3.39	1.27	.58	.28	.16	.09	.04	.02	.01	.....
42.10	400	.....	.....	.....	.....	.....	14.51	4.44	1.67	.75	.37	.21	.12	.05	.02	.01	.....
47.39	450	.....	.....	.....	.....	.....	18.38	5.61	2.11	.95	.47	.26	.15	.06	.03	.01	.....
52.60	500	.....	.....	.....	.....	.....	22.68	6.95	2.61	1.18	.58	.32	.18	.07	.03	.02	.01
63.20	600	.....	.....	.....	.....	.....	10.00	3.76	1.69	.84	.46	.27	.10	.05	.02	.01	.....
73.70	700	.....	.....	.....	.....	.....	13.60	5.11	2.31	1.14	.63	.36	.14	.06	.03	.02	.01
84.20	800	.....	.....	.....	.....	.....	17.80	6.68	3.01	1.49	.83	.47	.18	.08	.04	.02	.01
94.70	900	.....	.....	.....	.....	.....	.....	8.45	3.81	1.88	1.04	.60	.23	.11	.05	.03	.02
105.1	1000	.....	.....	.....	.....	.....	.....	10.42	4.71	2.32	1.29	.74	.29	.13	.07	.04	.02
157.9	1500	.....	.....	.....	.....	.....	.....	23.48	10.59	5.23	2.90	1.65	.64	.29	.15	.08	.05
210.5	2000	.....	.....	.....	.....	.....	.....	.....	18.81	9.30	5.15	2.94	1.15	.52	.26	.15	.08
263.0	2500	.....	.....	.....	.....	.....	.....	.....	23.40	14.52	8.05	4.60	1.80	.82	.41	.23	.13
315.8	3000	.....	.....	.....	.....	.....	.....	.....	.....	20.90	11.59	6.63	2.59	1.18	.60	.33	.19
368.1	3500	.....	.....	.....	.....	.....	.....	.....	.....	28.51	15.78	9.01	3.53	1.61	.81	.45	.26
422.0	4000	20.61	11.80	4.61	2.19	1.06	.58	.34
473.0	4500	26.10	14.90	5.83	2.65	1.34	.73	.43
526.0	5000	32.20	18.45	7.20	3.27	1.65	.90	.53

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Du Pont Blaster's Hand Book

Crammed into two hundred small pages between heavy board covers are practically all the facts about blasting and drilling which the average quarry operator cares to know. They are in the Blaster's Handbook, just issued by the explosives department of the E. I. Du Pont de Nemours and Company.

This comprehensive little book, for it is little, and of such size as to fit into a superintendent's pocket or into one of the pigeonholes of his desk, not only describes the practical methods of using explosives for nearly every purpose but gives technical information and useful data. Charts and diagrams are liberally sprinkled through the book, and there are some extremely valuable tables.

The book is the work of Arthur La Motte, manager of the technical section of the Du Pont Company. Although the work is frankly the handbook of an explosives manufacturing concern and devotes itself to the explanation of the company's products, the author has not made the mistake of making his work a piece of narrow sales propaganda.

All kinds of explosives are thoroughly discussed, and there is much practical advice given on storing and handling dynamite and blasting accessories. The question of causes of mis-firing comes in for a sane discussion and so does the thawing of dynamite.

The sections on making primers and the use of electric firing devices are especially noteworthy for their graphic treatment of some difficult problems. Drilling is treated in a manner befitting its importance. The author has not overlooked the obvious fact that successful blasting is predicated on efficient drilling and goes into the types of drills and such allied subjects as the size and spacing of holes and the care of bits.

An interesting section on loading drill holes was to be expected in such a work as this but the treatment is especially clear. Many subjects not ordinarily of interest to the quarryman are treated such as railroad and highway blasting, the digging of post holes, the scrapping of heavy machinery and blasting frozen material from railroad cars. It is certain that all who get this book will be interested in these sections.

A dozen pages are given over to quarrying and stripping and are of value to any operator or superintendent concerned with explosives.

Experimental Lime Plant To Be Built In Ohio

Arnold and Weigel, contractors and engineers, are breaking ground for an experimental lime plant at Woodville, O., and which when completed will be a source of facts open to every lime concern.

This plant will be located on a piece of leased property belonging to the Bruns Hydrated Lime Company. It will be used solely for experimental purposes and its practicability will insure the most thorough and extensive tests. It will be a stepping stone to higher quality for established lime concerns and for those just working into the game, as well as a valuable asset to state geologists and government experimentalists.

The plant will be of fire proof construction, embracing steel and concrete. All the latest ideas and developments of machinery will be incorporated. A half-size "Arnold" Standard Coal-fired kiln will be installed, with which it is contemplated to try out different types of kiln linings and fire brick, together with various types of fire-box construction. With an arrangement of this kind it is possible to try out any new suggestion which heretofore have been discarded, due to the fact that they could not be put to actual test with little expense. The grinding, hydrating, finishing and testing equipment will embrace only the very best and latest equipment. Further details of the plant will be made known upon completion. The total cost is estimated at \$20,000.

New Incorporations

Penn Limestone Co., Inc., (crushed limestone), Wilmington, Del.; \$100,000. Incorporator, Franklin L. Mettler, Wilmington, Del.

John Bechelli (cement construction), New York City. Capital, \$7,500. Incorporators: J. Bechelli, A. Lusardi, R. Cardone. (Atty. S. S. Bernstein, 229 Broadway.)

Troy Stone Co., Troy, N. Y. Capital: 500 shares—no par value. Directors: George C. Marcus, Ethel C. Marcus and Charles Cantor.

Climax Sales Conference

The Second Annual Sales Conference of the Climax Engineering Company, Clinton, Iowa, was held at Clinton, January 16. About fifty manufacturers and dealers of road-making machinery attended the gathering.

Friday night following the close of the Road Show, two Pullmans, conducted by President George W. Dulany, Jr., pulled out of the Northwestern Station, Chicago. The visitors arrived at Clinton the next morning and after breakfast at a hotel were conducted to the Climax Foundry, where the morning heat was being poured. From here the visitors were taken to the main shops of the company. There was no stated tour throughout the factory. Each man was allowed to go where he pleased and to see what interested him most.

Later on a business meeting and conference was held under the chairmanship of Mr. Dulany. The program followed the development of the gasoline engine, from its design to sale. Talks were made by executives, and members of the Climax staff were presented to the visitors. During the meeting a new model Climax engine was unveiled. The unveiling proved to be a real hit of the afternoon. It was stage managed perfectly. Most of the guests expected to see a new engine that would create a real sensation in the gas engine world—Chief Engineer Waters' model proved to be all that was claimed for it. It weighs one pound without the magneto and eight with it. The spark plugs were specially made in Mr. Waters' private factory. The engine has $\frac{3}{4}$ -inch bore a $\frac{3}{8}$ -inch stroke, and is operated on naphtha at about 2,000 R.P.M., developing 6.75 fly power. Being temperamental, it had to be coaxed before it would speed up, but it fully justified itself as the most unique gas engine yet built.

After the business meeting, the Convention adjourned until 7:30, when a banquet was held at the Clinton Boat Club.

President Dulany who is the Secretary of the "Society for the Prevention of Calling Pullman-Car Porters George," initiated four Georges into the Society. Lorimer Dunlevy, Sales Manager, was toastmaster. Short talks were made by the guests.

After the banquet, the hall was thrown open for dancing. The young

ladies of the Climax and their girl friends were able to entertain the visitors most acceptably until closing. The party then returned to Chicago in the special cars.

New Universal Cement Plant

The Universal Portland Cement Co. has just bought a tract of land in Cleveland upon which it intends to build a modern cement plant with capacity of a million and a half barrels annually.

The land is located on the Cuyahoga River in the heart of the industrial section. Limestone, one of the principal raw materials, will be transported from Rogers City, Michigan, by boat and unloaded at the plant. Other material required for manufacturing will be procured locally. The plant will be located on the Newburgh & South Shore Railway which connects with all railroads entering Cleveland. Its central location in Cleveland will permit cement to be trucked direct from mill to the job. Being located on the Cuyahoga River, cement can be shipped by boat to lake ports such as Buffalo, Toledo and Detroit.

Plans for the new plant which have already been drawn are being perfected and it is expected construction will start in the near future.

The Universal company now has plants at Chicago, Pittsburgh and Duluth with annual capacity of over 16,500,000 barrels, which upon the completion of the new plant at Cleveland will be increased to about 18,000,000 barrels capacity.

New Stoker Bulletin

Detroit Multiple Retort Underfeed Stokers are described in a new twenty-four page Bulletin just issued by the Detroit Stoker Company. Illustrations bring out many special features, such as the Level Fuel Bed and the method for controlling movement of the fuel throughout the entire process of combustion. The applications shown cover a wide range of operating conditions and include installations with preheated air, the burning of wood refuse with coal at high ratings, use of the stokers for burning Indiana and Illinois coal, etc. The Bulletin is known as No. 103.

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Newhouse Joins Cowham

Announcement has recently been made of the resignation of Mr. R. C. Newhouse as chief engineer of the Crushing and Cement Machinery Department of the Allis-Chalmers Manufacturing Company, to become vice president and manager of the Engineering Department of the Cowham Engineering Company of Chicago. Mr. Newhouse has long been associated with the cement industry and is considered one of the foremost au-



R. C. Newhouse

thorities on cement plant operation. His association with the Cowham Engineering Company will bring to this organization the experience of a lifetime devoted to design, construction and operation of cement, lime, gypsum, sand and gravel and crushed stone plants.

Mr. Newhouse was educated at Ohio Wesleyan University and after leaving college was employed by the Casparis Stone Company and the Columbus Construction Company of Columbus, Ohio. In 1905 he joined the Crushing and Cement Machinery Department of the Allis-Chalmers Manufacturing Company as sales engineer. In 1910 he was transferred to the main office of the company in Milwaukee, in charge of engineering in the Crushing and Cement Mill Machinery

Department, which position he has held until his recent resignation. In his position as chief engineer he was responsible for detail and general design of various machines manufactured for cement plants and similar industries. Mr. Newhouse has visited a large number of cement plants in the United States, Canada and Europe and has become intimately acquainted with the various problems of the cement industry.

In his position as chief engineer Mr. Newhouse has not only been responsible for the design of a large number of important machines used in the crushing and cement industries but also for the design of a great number of modern cement plants and rock and ore crushing plants. As an advocate of large combination grinding mills and other factors affecting the design of cement plants, he has contributed largely to the simplicity and efficient operation of the modern plant. He is the inventor and patentee of the Fairmount crusher, grid frame division head compeb mill, combination division head compeb mill, the Concovex, the Newhouse gyratory crusher. He also has been granted numerous patents covering gyratory crushers, jaw crushers, dust collectors, crushing rolls, conveying and transporting machinery, control systems for electric shovels control systems for automatically operated hoists and other similar devices connected with the crushing, cement and mining industries.

Mr. Newhouse is a member of the American Society of Mechanical Engineers and the Milwaukee Engineering Society, as well as several other professional and social clubs.

As manager of the Engineering Department of the Cowham Engineering Company, Mr. Newhouse will be responsible for the operation of the many plants controlled by that company. The Cowham Engineering Company has recently announced the proposed erection of a plant at Tampa, Florida, for the Florida Portland Cement Company, and one at La Salle, Illinois, for the Central States Cement Company.

Superior Sand & Gravel Co., Seattle, Wash. Capital, \$10,000. Incorporators: Ivan L. Hyland and Wilmon Tucker.

St. Joe Lime & Stone Co. (manufacturing lime), Dover, Delaware. Capital, \$200,000. (U. S. Corporation Co.)

Pit and Quarry **HAND BOOK****1926 Edition**

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- 1—Model 80 Marion. Shop No. 1312, 4-yd.
- 1—Model 76 Marion. Shop No. 2112, 2½-yd. or 4-yd. dipper.
- 1—70-C Bucyrus. Shop Nos. 1197, 2½-yd. dipper.
- 4—70-ton Bucyrus. Shop Nos. 920, 939, 977 and 1233, 2½-yd. dippers.
- 5—Model 60 Marion. Shop Nos. 1301, 1995, 1999, 2059 and 2238, 2½-yd. dippers.
- 2—60-C Bucyrus. Shop Nos. 1286 and 1388, 2½-yd. dippers.
- 1—45-C Bucyrus. Shop No. 1201, 1½-yd. dipper.

STEAM SHOVELS—Full-Revolving

- 1—80-B Bucyrus Caterpillar Type Steam Shovel. Shop No. 4002—New November, 1923. Equipped with 41-ft. 6-in. boom, 26-ft. dipper arm and 2½-yd. dipper. Located Madisonville, Ky.
- 2—Model 31-Marion. Shop Nos. 3341 and 3613, 1-yd. dipper. Traction wheel or railroad truck mounting.
- 1—18-B Bucyrus. Shop No. 1870, ¾-yd. dipper. Traction.
- 4—Type "B" Erie. Shop Nos. 1219, 1880, 1989 and 2144. Caterpillars. High lift booms, ¾-yd. dippers. Power boom hoist.
- 2—Type "B" Erie. Shop Nos. 1989 and 2144. Steel caterpillars. High lift boom, long dipper arms with ¾-yd. dippers. Power boom hoist.
- 2—Type "B" Erie. Shop Nos. 1219 and 1880. Caterpillars, high lift. ¾-yd. dippers.
- 1—Model 21 Marion. Shop No. 4294, steel caterpillars, standard boom and dipper arm, ¾-yd. dipper.
- 1—Type O Thew. Shop No. 1777, traction wheels, high lift equipment, 2/3-yd. dipper. A.S.M.F. boiler.
- 2—Model 104 Northwest Gasoline Shovels. Shop Nos. 213 and 263. Caterpillars, standard boom and dipper arm with ¾-yd. Manganese dipper. Located Verdigris, Oklahoma.

SIDE DUMP CARS

- 16—12-yd. Western Air Dump Cars. 19-ft. beds, box girder doors. Vertical cylinders.
- 26—12-yd. Western Air Dump Cars, 26 ft.
- 3—12-yd. Oliver Hand Dump Cars.
- 10—6-yd. K. & J. Steel Sills, Truss-rod doors. Located Burnaugh, Ky.
- 6—6-yd. Western, std. gauge, wood sills, Truss rod doors, automatic couplers.
- 11—6-yd. Western St. Gauge Steel Sills, new wood beds, truss-rod doors.
- 13—6-yd. Continental, std. gauge, Steel sills, truss-rod doors.
- 21—1½-yd. Western, 24-in. gauge.
- 1—4-yd. Western, 36-in. gauge, steel sills, truss rod doors.
- 6—8-yd. Western, 36-in. ga., double trucks, box-girder doors.

BUCKETS

- 1—1½-yd. Class "S" Page.
- 1—1-yd. Lakewood Clam Shell.
- 1—1½-yd. Williams Hercules Clam Shell.
- 1—1½-yd. Brown Hoist Clam Shell.
- 2—Mead-Morrison 1½-yd. Clam Shell.
- 2—1½-yd. O. & S. Coal Loading Clam Shells.

STEAM SHOVEL PARTS

All repair parts on hand for Model 60 Marion and standard 70-ton Bucyrus Steam Shovels.

- 1—Std. boom, dipper arm and ¾-yd. dipper for Type "B" Erie.
- 1—Boom for Marion 60 or 61 Shovel, length 35-ft. 22-ft. dipper arm, 1½-yd. dipper, long jack rams, etc.
- 1—Boom for Marion 60 or 61 Shovel, length 35-ft. 22-ft. dipper arm, 1½-yd. dipper, long jack arms, etc.
- 1—19-ft. 6-in. boom. 12-ft. sticks and ditcher bucket for Type B Erie Shovels.
- 1—22-ft. dipper stick for Type B, Erie Shovel.

LOCOMOTIVES—24-in. Gauge

- 3—7x12 Davenport Dinkies. Shop Nos. 1202, 1411 and 1524. Weight 9 tons.

- 1—6x10 Davenport Side Tank Dinky. Shop No. 1307. Weight, 7 tons.
- 1—7x12 Vulcan Saddle Tank. Weight 9 tons.
- 1—6-ton Whitcomb. Shop No. 1259. Gas drive. Gasoline.

LOCOMOTIVES—36-in. Gauge

- 1—9x14 Vulcan Dinky. Shop No. 1675. Weight, 14 tons.
- 2—7x12 Davenport, 4-wheel Saddle Tank. Shop Nos. 1566 and 1567.

LOCOMOTIVES—Standard Gauge

- 1—17 x 24 Davenport 6-wheeled switcher with tender. Shop No. 1269. Steam pressure 180-lbs. Weight 47-tons.
- 1—16x24 Davenport 4-wheeled Switcher. Shop No. 898, weight 38 tons, 170 lb. steam pressure. Located Verdigris, Oklahoma.
- 1—16x24 Baldwin 4-wheeled Switcher. Shop No. 34631. Weight 39 tons, 180 lb. steam pressure. Located Verdigris, Oklahoma.
- 1—16x24 Vulcan four-wheeled Switcher, with tender. Shop No. 1764. Steam pressure 180-lb. Weight 40 tons.
- 1—14x20 Vulcan 4-wheeled saddle tank. Shop No. 1893, built 1912, steam brakes, 180 lb. steam pressure.

DRAGLINE EXCAVATORS

- 2—Class 24 Bucyrus. Shop Nos. 858 and 859. Steam self-propelling trucks, 100-ft. booms, 3½-yd. Page buckets, electric lights, coal hoists. Located near East St. Louis.
- 1—Class 26 Bucyrus. Shop No. 813. Std and roller, 85-ft. boom, 3-yd. Page bucket.
- 1—Monaghan No. 2. Shop No. 789. Std. 60-ft. boom, 2-yd. bucket.
- 1—30-B Bucyrus. Shop No. 3641. Caterpillar, 40-ft. boom, 1-yd. bucket.
- 1—Model 210 P&H Gasoline Dragline. Shop No. 1077. Armored caterpillars. 40-ft. boom, 1-yd. Page bucket.
- 1—Complete Caterpillar arrangement for Class 14 Bucyrus Dragline equipped with armored tread.

CRANES

- 1—Model 102 Northwest Gasoline. Shop No. 102. 40-ft. boom. Bucket-operating.
- 1—Type "B" Erie. Shop No. 559. Tracium or railroad truck mounting. 32-ft. boom. Bucket-operating.
- 1—10-ton Industrial, 4-wheeled. Shop No. 1989. 40-ft. boom, bucket operating.
- 1—15-ton Brown Hoist, 42-ft. boom.
- 2—23-ton Type "B" McMyler. Shop Nos. 2015 and 2108. 40-ft. booms, bucket-operating.
- 1—15-ton Ohio. Shop No. 3441. 8-wheeled, M.C.B. trucks, 40-ft. boom, with 10-ft. extension, bucket-operating drums, 1-yd. bucket.
- 1—25-ton Industrial, 8-wheeled. Shop No. 3261. Bucket-operating, 55-ft. boom, with 20-ft. extension.
- 1—25-ton Browning, 8-wheeled. Shop No. 1560. 50-ft. boom, bucket-operating drums and 1½-yd. Mead-Morrison clam shell bucket.

MISCELLANEOUS

- 2—36-ft. Camp Cars.
- 1—No. 7-S Knickerbocker Concrete Mixer, with power loader and water tank on trucks. New.
- 1—10-ton Austin Gasoline Road Roller.
- 1—10-ton Monarch Steam Road Roller.
- 1—American Railroad Ditcher No. 459.
- 1—8-ft. Austin Giant Road Grader.
- 1—6½x10 D.C. D. D. American Hoist, with butt strapped boiler.
- 1—7x10 D.C., D.D. Lambert Hoist, without boiler.
- 2—Chicago Pneumatic Portable Air Compressors, 210 cu. ft. per minute. Gas driven.
- 2—Sullivan "WK-31" Portable Air Compressors, 150 cu. ft. per minute. Gas driven.
- 16—No. 8 Milburn Carbide Lights, 8000 Candle Power.
- 4—No. 12 Milburn Carbide Lights, 12,000 Candle Power.
- 9—Milburn Reliance Carbide Lights.
- 6—Milburn Builders Carbide Lights, 500 Candle Power.
- 12—Buhl Portable Air Compressors. New.
- 1—No. 55 Buhl Portable Air Compressors.

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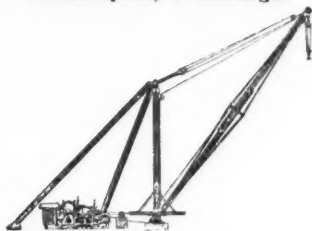
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2—52 H.P. single drum Lidgerwood, with 220 volt, 60 cy., 3 ph., A.C. motor, complete with one winch head.

1—75 H.P. double drum Clyde hoist, capacity 10,000 lbs. on rear drum, 5,000 lbs. on front drum, with 220 volt, 60 cy., 3 ph. motor.

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Large quantity late model American Stiff Leg Derricks, mast 14x14x40 ft. booms 14x14x 60 ft., stiff legs, 14x14x50 or 60 ft. sills if desired, with 12 ft. steel bull wheel, for hook work or bucket operation.

Large quantity late model American Stiff Leg Derricks, mast 16x16x40 ft., booms 14x14x80 ft., trussed with hog rods, legs and sills 14x14 with 16-ft. steel bull wheel, arranged for hook or bucket operation.

Also several Guy Derricks, wood or steel, arranged for single line work or for operating clam shell bucket.

CRANES

1—15-ton O & S, 8-wheel M. C. B., 40-ft. boom, bucket operating.

1—O & S 7-ton Crane, 30-ft. boom, 3/4-yd. clamshell bucket, traction wheels.

1—Byers Auto Crane, 30-ft. boom, 3/4-yd. bucket, traction wheels, steam.

LOCOMOTIVES

1—Davenport std. ga. 20-ton, 10x16 cylinders, saddle tank. No. 1497.

1—Porter std. ga. saddle tank, 14x22 cylinders, weight 42 tons, like new, only one year of service, shop No. 6853.

3—7-ton, 24-in. ga., Plymouth, gasoline.

6—3-ton, 24-in. ga., gasoline. 3—Plymouth.

3—Whitcomb Fordson.

STEAM SHOVELS

2—Type "B" Erie Shovels, mounted on caterpillars; one with Crane Boom.

2—Thews on traction wheels, 1. Type A1, 1. Type 0.

CABLEWAYS

11—3 and 5-ton, Street Bros. (Howson) Cableways, complete with automatic dump buckets.

STEAM HOISTS

12—Three-Drum Hoists, with or without boilers. Sizes 10x12, 9x12, 9x10, 8 1/4 x10 and 7x10, with separate swingers for derrick work. All makes.

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2—No. 3 1/2 Keystone drills.

6—Model 21, Waugh "Denver" derrick drills.

8—Model 31, Waugh "Denver" column drills.

1—D.W. 64, Sullivan column drill.

1—Sullivan tripod drill.

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HOISTING ENGINES

Electric

- 25—37-hp. American, double drum, with attached swingers banked or side levers, A.C. or D.C. motors.
- 1—50-hp. American, double drum, with attached swinger, A.C. motor.
- 1—75-hp. Clyde, triple drum, attached or independent swinger, A.C. or D.C. motor.
- 2—75-hp. Lambert, double drum, A.C. or D.C. motor.
- 1—75-hp. Lambert, double drum, with attached swinger, A.C. or D.C. motor.
- 1—100-hp. Lambert, double drum, with or without swinger, A.C. or D.C. motor.

Gasoline

- 3—50-hp. American, double drum, with attached swinger, equipped with new Hercules gasoline engine.
- 3—35-hp. American, double drum, with attached swinger, equipped with new Hercules gasoline engine.
- 2—30-hp. Lambert, double drum, with attached swinger, equipped with new Hercules gasoline engine.

Steam

- 1—Lambert, 9½x12, triple drum, with butt strap boiler and 6½x8 independent swinger.
- 1—Byers, 7x10, triple drum, with attached swinger and boiler.
- 1—Lidgerwood, 8½x10, double drum, with boiler.
- 1—Lidgerwood, 8½x10, double drum, skeleton hoist.
- 1—Lidgerwood, 12x12, double drum hoist, skeleton.
- 1—Lidgerwood, 8½x10, bridge hoist, butt strap boiler, 4 independent winch heads.
- 1—Lidgerwood, 9x10, double drum, with boiler.

Derricks

- 1—Terry 15-ton stiffleg Derrick, 3 line service, 65-ft. steel boom.
- 20—American stiffleg Derricks, 14x14 timbers, 12-ft. bull wheels, 65-ft. booms.
- 5—8-ton Jinniwinks.
- Several small Derricks, 25- to 40-ft. booms.

Locomotive

- 1—Porter 40-ton Saddle Tank Locomotive, standard gauge, exceptionally good condition.

Miscellaneous

- 1—Traylor Bulldog, No. 8, Gyrotory Crusher.
- 1—Bucket elevator 27 ft. centers, new.

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- 2—40 H.P. Gasoline Motors, Marine type, 3 cys., size 8"x10".

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STEAM SHOVELS

- 1—70-C Bucyrus. Shop No. 1749. Standard gauge, railroad, 2½-yd. dipper.
- 1—Model 60 Marion. Shop No. 1463. Standard gauge, railroad 2½ yd. dipper (butt strap boiler).
- 1—18B Bucyrus, revolving. Shop No. 1764. Traction wheels, ¾-yd. dipper.
- 1—Type B Erie Revolving Steam Shovel, traction wheels, standard boom, ¾-yd. dipper.
- 1—Model 212 Marion (revolving). Shop No. 4620. Mounted on trucks, 55-ft. boom, 34-ft. dipper stick, 1¾-yd. dipper. Only used enough to be broken in; compares favorably with new.

LOCOMOTIVES

- 5—7-ton Plymouth gasoline, 36-in. gauge.

DRAGLINES

- 1—210 P & H Gasoline. No. 1349, on caterpillars. 76-hp. Twin City Engine, 48-ft. boom, 1-yd. bucket. Burns kerosene oil fuel.
- 1—Class 24 Bucyrus, steam operated, skids and rollers, 100-ft. boom, 3½-yd. bucket.
- 1—Class 24 Bucyrus Electric Driven, skids and rollers, 100-ft. boom, 3½-yd. bucket.

DUMP CARS

- 18—12-yd. Western Hand Dump Cars, Standard gauge.
- 21—5-yd. Western Hand Dump 36" gauge 4307.
- 35—1½-yd. Western, 24-in. gauge, Dump cars.

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- 2—20B Bucyrus Revolving Steam Shovels, high lift. Shop Nos. 4309, 4307. Mounted on caterpillars; ¾-yd. dipper.
- 1—30-B Bucyrus, revolving standard steam shovel. Shop No. 3993. Caterpillar. 1-yd. dipper.

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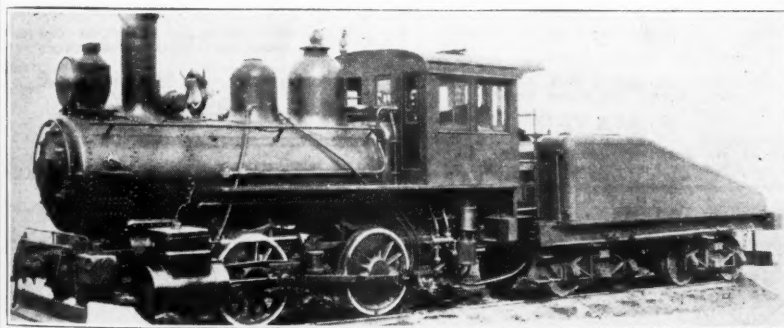
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P. & H. 206 Gas 38' Boom.

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Dump, new 1923, Heavy Duty 4-pedestal,
STEEL DRAFT BEAMS Box Girder Doors;
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1-OSGOOD HEAVY DUTY, full revolving, Shop
No. 1124; new late 1923, ALL STEEL
CATERPILLARS, A.S.M.E. boiler; ¾-yd.
dipper; HIGH LIFT; Boom Hoist; slightly
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ALL STEEL CATERPILLARS; 35 ft. boom,
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- 1-48x36" Traylor Jaw, manganese fitted.
- 1-24x36" Farrell, manganese fitted.
- 1-48"-36" and 18" Symons Disc Crushers.
- 1-No. 12-K Gates.
- 1-No. 7½-D Gates, manganese fitted.
- 1-No. 6-D Gates, manganese fitted.
- 1-No. 5 Austin gyratory.
- 1-No. 4 Allis Chalmers gyratory.
- 1-No. 3 Traylor, gyratory.

CRANES

- 1-Browning 20 ton, 50 ft. boom.
- 1-Industrial 15 ton, 35 ft. boom.
- 1-Northwest, caterpillar, 40 ft. boom.
- 1-Byers No. 14, 35 ft. boom, will rent.

SHOVELS

- 1-Model 103-C Bucyrus, cat. also R.R. trucka.
- 1-Model 50-B Bucyrus, caterpillar, will rent.
- 1-Model 37 Marion, caterpillar.
- 1-Model 21 Marion, caterpillar.
- 1-Model 31 Marion, caterpillar.

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140 So. Dearborn St., Chicago, Ill.

SLACKLINE CABLEWAYS GRAVEL PLANT

- 1-Sauerman 2 Cubic Yard Bucket Slack-
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ft. span, including one (1) 100 ft.
steel mast with ball and socket base
and swivel top. Also one (1) 200
H.P. Thomas Electric Two Speed Cable-
way Hoist.
- 1-Complete machinery layout consisting of
¾ Yard Slackline Cableway Outfit with
50 H.P. Thomas Two Speed Electric
Hoist, Telsmith Washing Screen, feeder,
sand tank and 80 ft. steel mast for
cableway.
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traction.

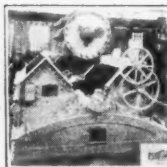
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We changed our method of
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for selling crusher which is
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The following used 220 or 440
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- 3-7½ H.P. Cleveland ..1800 R.P.M.
- 1-20 H.P. Cleveland .. 900 R.P.M.
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- 1-40 H.P. Western
Electric 900 R.P.M.
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CRANES & SHOVELS

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- 1—P & H, 207, Combination. Latest type, A.1.
- 1—Bucyrus, 14B. Cats. A.1. \$4300.00
- 1—Marion, 21, Cats. First class shape \$3750.
- 1—Northwest 104, used nine months.

MISCELLANEOUS

- 1—55 Ton Oil Electric switching locomotive.
- 1—1000' Compressor, direct motor drive.
- 1—Sauerman, 1 yd. dragline, complete.
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Stripping Shovel

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- 1—100 HP Steam Shovel Boiler 750
- 2—30 HP Single Drum Electric Hoists Each 900
- 1—100 KW Generator direct connected. 650

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I have equipment located in practically every state in the Union.

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- 2—3-ton Whitcomb 24" ga. Gaso. Loco.

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- 1—42x48 Allis-Chalmers Jaw Type mang. fit.
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- 1—24" Symons Disc Crusher.
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Also others of smaller sizes. I have Elevators, Screens, Hoists, Cars, Cranes, Compressors, Draglines, Blast Hole Drills, Track and all other Quarry Equipment to go with above.

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350	Westinghouse	CW	435
200	Westinghouse	CW	885
200	General Electric	IM	585
75	General Electric	IM	720
50	General Electric	MT	1200
50	Westinghouse	HE	900
50	Howell	IM	720
40	Westinghouse	CW	690
52	General Electric	ITC	570
40	General Electric	MT	685
35	Northern	HEW	720
30	Westinghouse	CW	1800
30	Westinghouse	FH	1800
30	General Electric	MT	1200
30	General Electric	MT	900
30	Wagner	BR	850
30	Westinghouse	MW	850
25	Burke	EMV	720
20	General Electric	IM	900
18	General Electric	ITC	680
15	General Electric	MT	1200
15	General Electric	MT	900
15	General Electric	IM	720
10	General Electric	IM	900
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7 1/2	Ideal	AVE	1130
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Above are slip ring motors only, in Cleveland stock. Complete stock of squirrel cage and DC motors up to 500 HP.

SPECIAL NEW MOTORS

3 phase, 60 cycle, 220 volt, 1800 R.P.M. squirrel cage motor with pulley and rails

5 HP

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SMALL STANDARD GAUGE WHITCOMB GAS LOCOMOTIVE

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Also Two of Smaller Gauges
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Shovel Attachment for Model 6T Austin Gasoline Caterpillar Crane. Forward particulars and price to

A. R. GELINAS
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WANTED—LOCOMOTIVE Standard Gauge

Gas or Steam, 20 to 40 ton. Send complete description, including draw bar pull of same, price F. O. B. shipping station, etc. Address Box 22 Pit and Quarry, 538 S. Clark St., Chicago, Ill.

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- 1—No. 2 McMyler Convertible Caterpillar Gas Shovel, 3/4-yd. dipper.
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Erie Type B Steam Shovel, 3/4 yard, Caterpillars, Marion Model 36 Steam shovel, 1 1/2 yard, Caterpillars, 2 Davenport 36" gauge, saddle tank locomotives, 18 tons, 30 Koppel 36" gauge, all steel dump cars, capacity 2 yds.

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Reeves tractor, locomotive type cross compound, rating—32 H.P. on draw bar, 120 H.P. on belt. Suitable for pumping sand and gravel. In good running condition. Will sell at a bargain.

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Man capable of acting as combination superintendent and cableway operator for Bank Sand and Gravel Plant. Sauerman 2-yd. electric dragline. Permanent position for right man. Location—Leetonia, O. Write giving full details, personal qualifications, previous experience, salary expected.

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36 in. gauge Davenport locomotive, 10x16, 4 wheel saddle tank. New tires, Hartford in operation on boiler, good condition. Price \$950.00.

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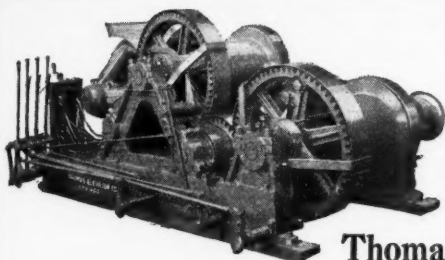
42"x48" Jaw Crusher, Manganese fitted; must be in first-class condition for operation. Give full details, price, and location in answer. Address Box 11, Pit and Quarry, 538 So. Clark St., Chicago.

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120 acres best gravel lands in the west. Deep gravel beds containing fine porcelain sands. Exceptional location adjoining Mississippi River and Railroads. Write at once for further information.

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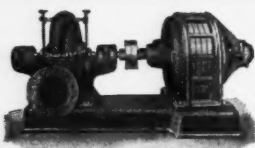
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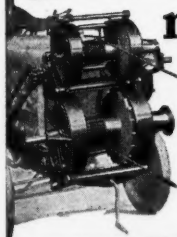
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Complete Crushing and Screening Equipment

The best evidence of the efficiency and durability of Acme portable and stationary crushers and crusher plants is their record in actual plant operation. What-

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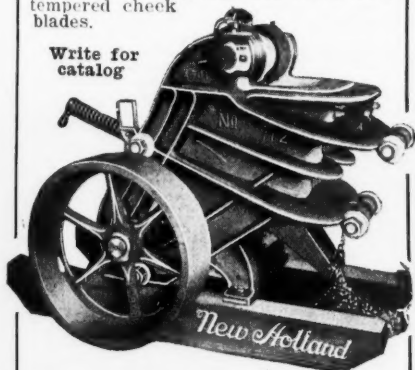


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The New Holland Jaw Crusher

Means economy in time, operating costs and upkeep. Has interchangeable jaws, long spring and extra hard tempered cheek blades.

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SPEEDER

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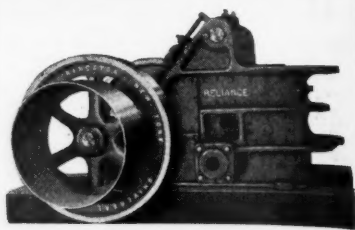
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under all conditions is assured on RELIANCE units through the use of a force feed GREASE system instead of oil.

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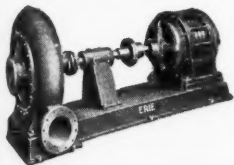
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RUBERT M. GAY COMPANY, Inc. 114 Liberty St., N. Y.

Pump Breakdowns are Costly!

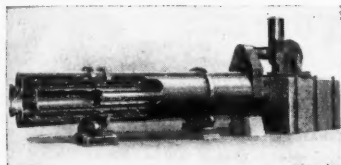


The sand and gravel industry demands efficient and consistent pump performance. ERIE PUMPS, backed by 35 years of successful manufacture, offer you pump insurance. The factory back of ERIE PUMPS offers you the advice of a corps of engineers who are pump specialists, trained to solve your problems.

Send today for our new
24 page Bulletin No. 41

ERIE PUMP & ENGINE WORKS, 153 Glenwood Ave., MEDINA, N. Y.

Ruggles-Coles Dryers



Built to dry at the
lowest ultimate cost.

Ruggles-Coles Engineering Co.
York, Pa.

120 Broadway
New York

Newhouse Bldg.
Salt Lake City

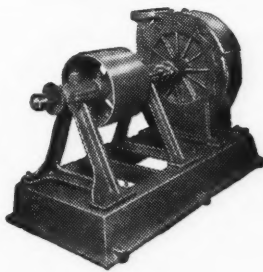
REAL PUMPING

In the sand, gravel and Dredging
Pump field there is no more complete service than

LIGHTNING PUMPS

Learn what experienced users
think about them. Write today for
illustrated literature.

KANSAS CITY HAY PRESS CO.
Kansas City, Missouri



Austin Portable Conveyors

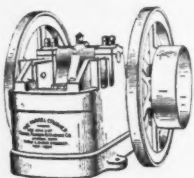
*Especially intended for handling
gravel, stone, sand, and
similar materials*

Made in two styles and all lengths between 16 and 68 ft. Furnished without power, or with gasoline or electric drive. Unmounted, or with 2 or 4 wheeled trucks as length requires. Write for special literature and prices.

Austin Manufacturing Co.
Chicago San Francisco New York

"FARREL" CRUSHERS

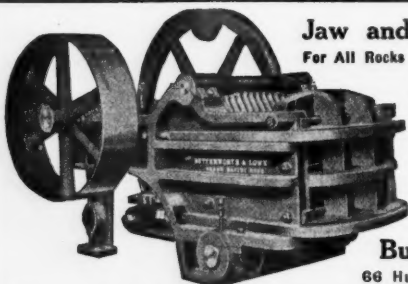
—World Famous—



Thousands in use on the hardest rock. Built in all sizes, 6"x3" to 60"x48". Complete rock crushing plants designed and equipped, also sand and gravel, washing and screening plants.

Send for latest bulletin E.

Earle C. Bacon, Inc., Engineers, 26 Cortlandt St., New York



Jaw and Rotary Crushers

For All Rocks and Ores Softer Than Granite

GYPSUM MACHINERY

We design modern Plaster Mills and make all necessary Machinery, including Kettles, Nippers, Crackers, Buhns, Screens, Elevators, Shafting, etc.

SPECIAL CRUSHER-GRINDERS FOR LIME

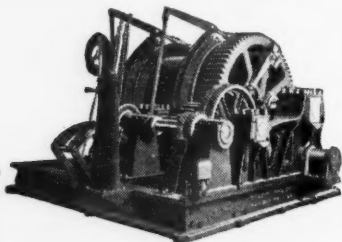
Butterworth & Lowe

66 Huron Ave., Grand Rapids, Mich.

Rotaries—20" to 47" inside diameter. Many variations.



Nippers—17x19", 18x26", 20x30", 24x36" & 26x42"



FLORY Hoists are dependable, rugged, and very efficient in operation. There is a Flory Hoist for every purpose. Use one on your next job.

Write for our latest catalog—we'll gladly send it to you. Flory engineers will assist you with any hoist problems.

Agents in Principal Cities

S. FLORY MFG. CO.
Bangor, Penna.

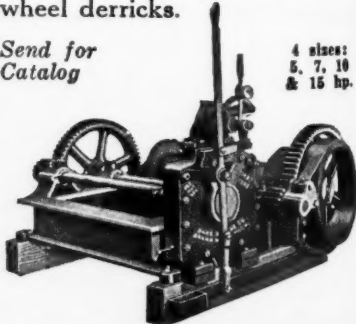
DAKE SWINGING ENGINES PRODUCE

**Quicker Swings
More Work
Less Trouble**

The experience of use has proven them—That's why they are so universally used on bull wheel derricks.

Send for
Catalog

4 sizes:
5, 7, 10
& 15 hp.



DAKE ENGINE COMPANY
Grand Haven, Mich., U. S. A.

TRULY there is much in a name that has taken 183 years to make.

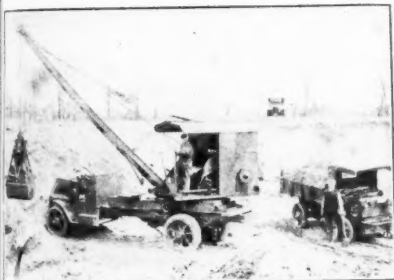
INSTALL Manganese steel wearing parts and note the

SAVING in repair bills and operating costs.

CONFIDENCE in your equipment will relieve you from worry.

ONLY ONE steel is called Tisco. Insist on it.

**Taylor-Wharton
Iron & Steel Co.**
HIGHBRIDGE, N. J.



ABILITY Plus MOBILITY!

ABILITY—to dig 400 yds. per day from this pit and load trucks in 2 to 4 minutes each.

MOBILITY—to travel to another pit, a Railroad Siding, etc., at a seconds notice at truck speed of 10 miles per hour.

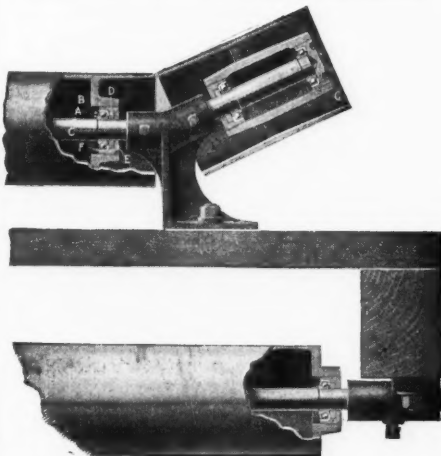
The Universal is a 5-ton full circle swing crane—it digs with $\frac{1}{2}$ clamshell or dragline bucket.

For Details write for Bulletin 282

The Universal Crane Co.

942 Swetland Bldg., Cleveland, O.

CONWEIGH



Ball-Bearing Idlers

CONWEIGH Ball Bearing Troughing and Return Idlers have solved many a troublesome conveyor problem by the natural reduction of friction which they produce.

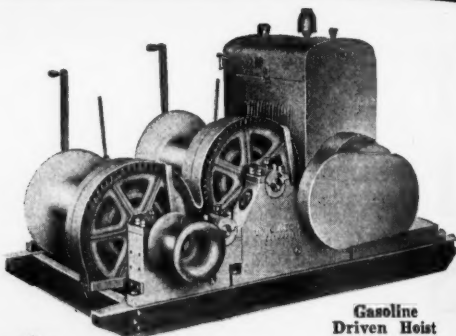
Conweigh Ball Bearing Idlers are easy to lubricate, of durable hardened steel construction and give maximum conveyor volume.

Submit your problem to us.

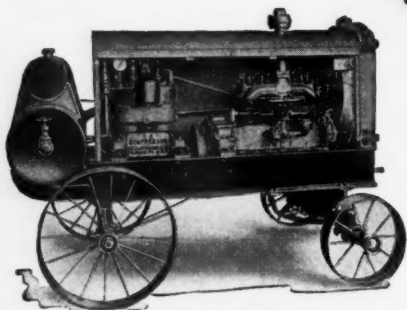
**THE CONVEYING
WEIGHER COMPANY**
ENGINEERS & CONTRACTORS
90 West Street, New York

Economizing Power

Friction is the constant enemy of power—always eating into power and reducing efficiency.



Gasoline
Driven Hoist



Portable Air Compressor

Correctly designed and proportioned bearing surface reduces friction to a minimum, thereby preventing lost power and saving what is developed for actual operation.

O. K. Clutch & Machinery Co.
BOX 305, COLUMBIA, PA.

Loading One Yard Per Minute

That's the Burch Conveyor Speed

Whether it's from stock pile or direct from pit, the Burch's easy portability and adaptability give you fast loading always.

The facts and figures regarding the advantages of using Burch All Steel Portable Conveyors will interest you. Let us send you our literature.



THE BURCH PLOW WORKS CO.
Crestline, Ohio

PLANT CAPACITY

Should Determine Your Shovel Requirements

If you only handle 200 to 400 yards per day, the Model 4 Bay City is "as much shovel" as you need. Fills the gap between hand labor and high priced equipment.

The economical one-man shovel or crane on the average size job.

BAY CITY DREDGE WORKS

BAY CITY, MICH.

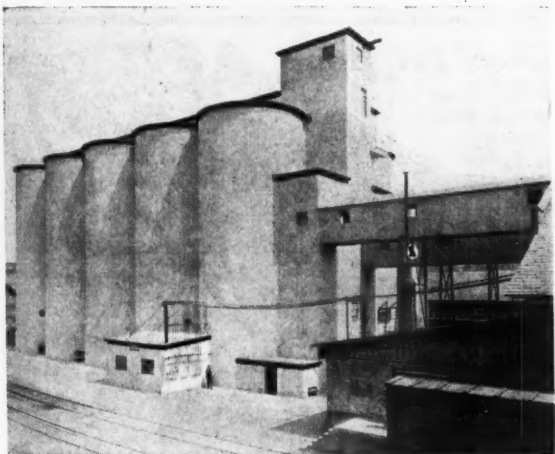
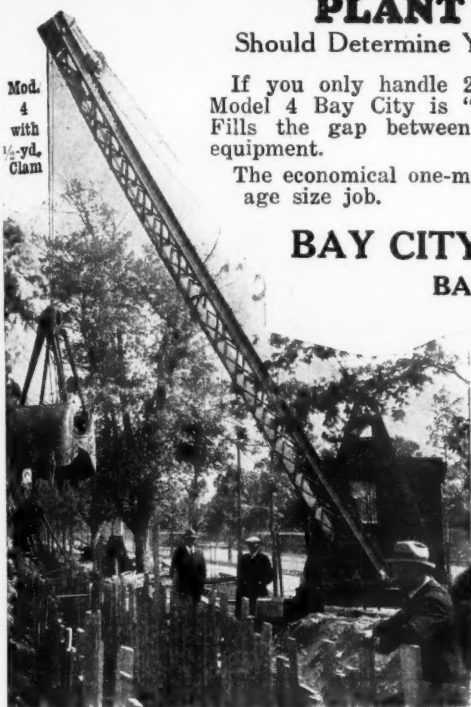
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Model 4
operates
Shovel
Clam
Skimmer
Ditcher
Dragline

Gas or
Electric
Power



Mod.
4
with
1/2-yd.
Clam



LAWRENCE PORTLAND CEMENT COMPANY
SIEGFRIED, PA.

Designers and
Builders of
Cement Storage
Pack Houses
Slurry Tanks
Stone Bins
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and
Machinery
Installations

*Designs
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Furnished
on Request*

Burrell Engineering & Construction Co.

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HOLDS THE RECORD

"We hold the record for our section of the state and intend to keep it with our **UNIVERSAL**"

said a Wisconsin user.

GENUINE OWNER SATISFACTION

explains why Contractors, Engineers, Pit and Quarry operators prefer

Universal Crushers

Twenty two sizes. Jaw openings 4x6" to 15x36". Capacities up to 450 tons per day. Manganese equipped and guaranteed for heavy duty.

Let us know your needs.

UNIVERSAL CRUSHER COMPANY

631 C AVENUE WEST

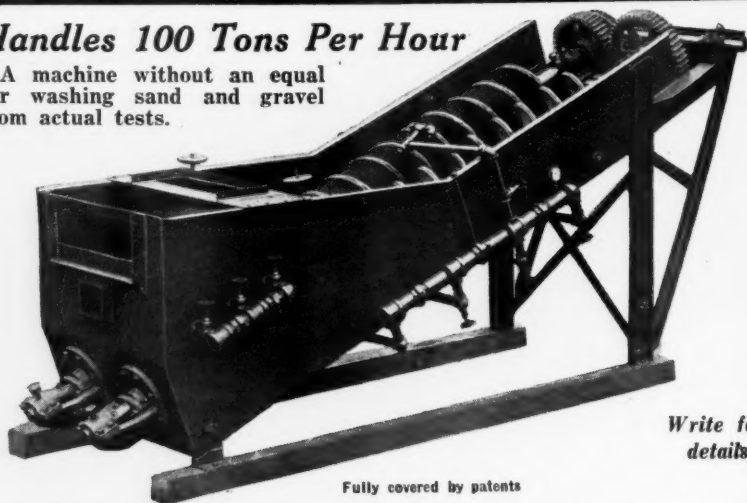
CEDAR RAPIDS, IOWA



The PERFECT CLASSIFIER

Handles 100 Tons Per Hour

A machine without an equal for washing sand and gravel from actual tests.



Fully covered by patents

Write for details

PERFECT CLASSIFIER COMPANY
105 FIRST AVE., SOUTH NASHVILLE, TENN.

Domestic



Portable Air Compressors

The above illustrated DOMESTIC Portable Air Compressor is furnishing air for drilling in the quarry of J. B. Burkhart, Chambersburg, Pa., for getting out stone for state road construction.

The "Domestic" is an ideal portable air plant for any quarry. Let us send you Bulletin "A P" giving full particulars of the several sizes we manufacture.

Domestic Engine & Pump Co.
Manufacturers
SHIPPENSBURG, PENNA.



A Taylor Spiral Riveted Pipe Line draining North Lake, Michigan, into Carp River.

Drainage Lines

TAYLOR Spiral Riveted Pipe is light enough to be installed and moved from one place to another by few men, and it is strong enough to stand rough usage without deformation. The Taylor Forged Steel Flanges cannot be broken and permit drawing up to an absolutely tight joint.

Taylor Spiral Riveted Pipe is made of copper bearing steel, specially galvanized or coated with asphalt—a double protection from rust and corrosion. Every length is hydraulically tested.

If you are planning a drainage or water line Taylor Spiral Riveted Pipe will be found most economical. Write for the 88 page "production book."

AMERICAN SPIRAL PIPE WORKS

Main Office and Works:
Box 485, Chicago, Illinois
New York Office: 50 Church Street

TAYLOR

Spiral Riveted
PIPE

P&Q 3-1K-BTG.

BIGGER AND BETTER

The New 1925 Model

**NELSON
FORDSON LOADER***"The Standard of Service"*

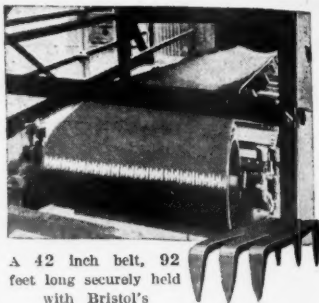
Sixty to eighty yards an hour
Self feeding without hand labor.
Slow crowding keeps buckets full.
Strong, well designed frames.
Saves labor and truck time.
All work in plain sight of operator.

Swivel spout ten feet high.
Side or end loading of big trucks.
Digs its own road into the pile.

—*—
Write for Catalog and Prices, or
Ask your Ford Dealer.

—*—
**N. P. NELSON IRON
WORKS, Inc.**
Passaic, N. J.

—*—
Where we lead others follow



A 42 inch belt, 92
feet long securely held
with Bristol's

**The Master
Mechanic says:**

"I use Bristol's Steel Belt Fasteners because they can be applied so easily and quickly, and because they stand up better than any belt fastener with which I am familiar."

An expert belt lacer or special equipment is not necessary with Bristol's Belt Lacing. You can use it for repairing a longitudinal break as well as a break across the belt. Use them when you put on a new belt; also to take up slack.

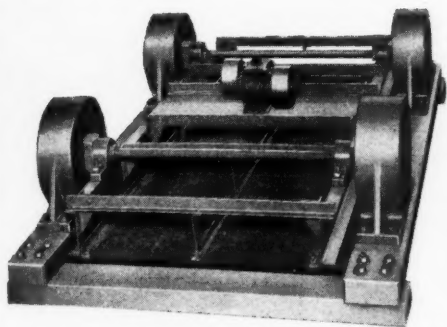


Special sizes for different thicknesses of conveyor belts—from 7/16 to 13/16 inch, ten-ply and extra heavy. Let us send you samples and Bulletin 719-0.

THE BRISTOL CO.,
Waterbury, Conn.



YOU CAN'T STOP THIS VIBRATION



With a heavy load—it keeps right on—the entire screening surface vibrating equally.

Set it at a lower angle—and the material keeps moving forward—an exclusive patented feature of this screen. Nothing to adjust or get out of order.

Bulletin H-38

WE BUILD THE ROLLERLESS ROTARY SCREEN

GALLAND-HENNING
MANUFACTURING COMPANY
MILWAUKEE — U. S. A.

All-Steel BINS



Self-Cleaning

No Dead Storage

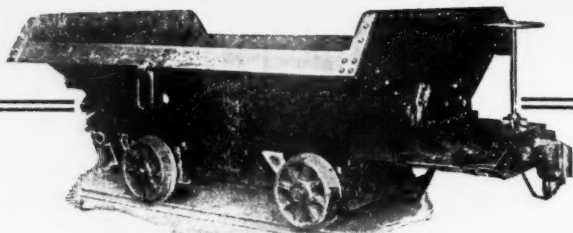
A Blaw-Knox Bin will serve year after year without expense or interruption for repairs or rebuilding. Easy to erect. Simple and sturdily constructed, Blaw-Knox Bins represent permanent, economical plant. *Built in all sizes:*

<i>Load your bins with a husky</i>	SIZES
<i>Blaw-Knox DREAD-NAUGHT Bucket.</i>	85, 135, 210, 300 tons or any capacity to suit special needs.

BLAW-KNOX COMPANY

652 Farmers' Bank Bldg.,
Pittsburgh, Pa.

BLAW-KNOX



QUARRY CARS THAT ENDURE

Under Most Abusive Loading Conditions

ATLAS CARS are designed to reduce haulage costs and last longer

"They Do Both—Why Not Investigate?"

Engineering Service Especially Developed in Quarry Car Design

THE ATLAS CAR & MFG. CO.

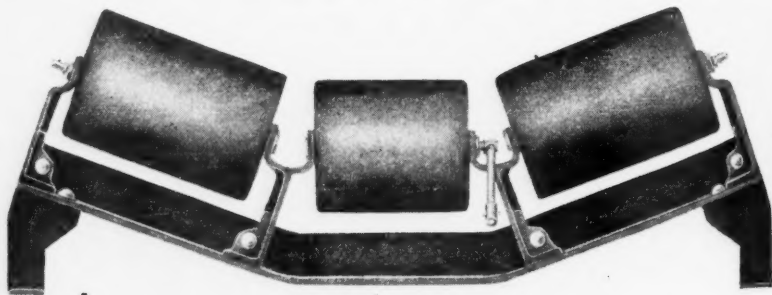
1140 Ivanhoe Road

CLEVELAND, OHIO

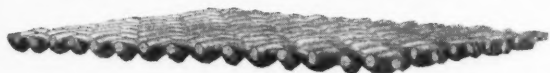
Quarry Cars, Rocker and Gable Bottom Cars, Special Cars of All Kinds

VARIETY IRON ^{A N D} STEEL WORKS CO.

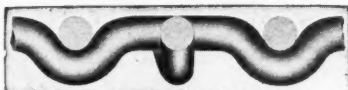
ENGINEERS : FABRICATORS : ERECTORS
CONVEYORS <sup>A
N
D</sup> ELEVATORS OF ALL KINDS



MAIN OFFICE & WORKS, 1277 East 40th St., CLEVELAND, OHIO
WESTERN OFFICE: BRADY CONVEYORS CORP., 20 West Jackson Blvd., Chicago

TRADE **ROL-MAN** MARK**WOVEN MANGANESE STEEL SCREENS****Highest Efficiency—Greatest Economy—Longest Life**

Note Face of Screen is flat

Both rods
crimped pre-
venting dis-
placement.

Enlarged section through centre of mesh.

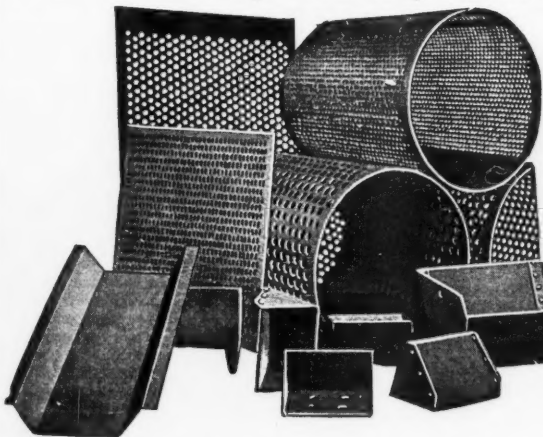
Note closed
double locked
mesh.

The Crimping is all on one side of screen. Makes wearing side smooth and flat. Will handle 50 to 100% more material than perforated plate.

Made in all shapes and sizes—Flat, Rolled to Circles or Cones.
To Fit ANY Revolving, Shaking or Vibrating Screen.

Manganese Steel Forge Co.Richmond & Erie Ave.,
PHILADELPHIA, PA.

Manufacturers of "ROL-MAN" Rolled and Forged Manganese Products

Perforated Metal Screens
FOR STONE, SAND, GRAVEL, ETC.

Plates flat; rolled to diameter or radius for revolving and conical screens butted or lap joints.

Elevator Buckets
in all styles
and sizes

HENDRICK MFG. CO.,39 Dundaff Street
CARBONDALE, PA.

30 Church St., New York City

954 Union Trust Bldg., Pittsburgh, Pa.

SUPREMACY!

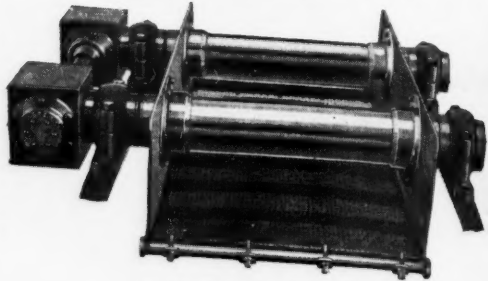
PERFECT BALANCE

"Vibration where you want it"

IN every industry there is some one product that by sheer merit and outstanding quality and performance is accepted as the standard by which other products may be judged.

In the screening industry it is Simplicity Super Vibrating Screen. Large capacity — close sizing.

*"Twice the Capacity
at half the cost"*

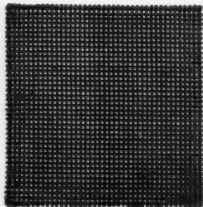


*Built like a motor car
Rugged as a battleship*

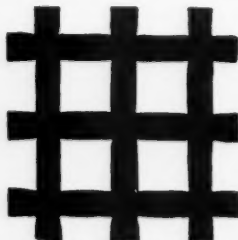
LITERATURE

SIMPLICITY ENGINEERING COMPANY

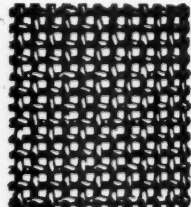
Durand, Mich.



40 Mesh; .0135 Wire



2 1/2 Mesh; .105 Wire



12 Mesh; .047 Wire

SERVICE!

is the one thought behind every operation in the manufacture of—

"CLEVELAND" Double-Crimped Wire Cloth

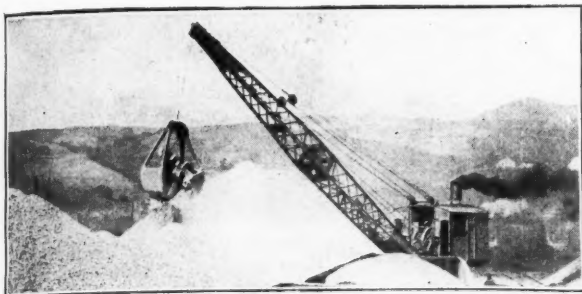
Uniform fineness and long service will be assured by its use in screening SAND, GRAVEL, CRUSHED STONE AND CEMENT.

Large stock always on hand; special mesh manufactured to suit requirements at right prices.

THE CLEVELAND WIRE CLOTH & MFG. CO.

3579 EAST 78TH STREET
CLEVELAND, OHIO

QUICKER, CHEAPER, BETTER PROFITS
THESE ARE THE RESULTS OBTAINED BY THE VARIOUS
INDUSTRIES USING
OHIO LOCOMOTIVE CRANES



The OHIO
IS CON-
STRUCTED
OF
90% BASIC
OPEN
HEARTH
STEEL
CASTINGS.

CAPACITIES
15 TO 40
TONS

THE OHIO LOCOMOTIVE CRANE CO.

ELM ST., BUCYRUS, OHIO

CHICAGO OFFICE, RAILWAY EXCHANGE BLDG.

NEW YORK, 30 CHURCH ST.

KOPPEL—A Trade Name for the
Best Quarry Cars

We build a complete line of cars—many varied designs.
 Our Quarry Bulletin will be mailed upon request.

Koppel Industrial Car & Equipment Company
Koppel, Penna.

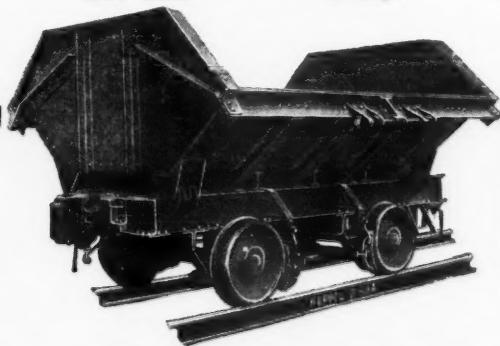
SALES OFFICES:

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New York

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San Francisco

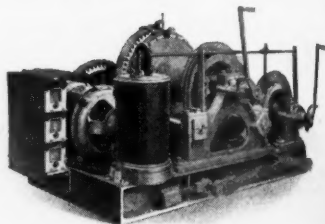


This is our
No. 2934 a
strong built
car that
gives service.



"O. & S." Electric Hoists

Our line of Electric Hoists ranges in capacity from 350 to 6500 pounds on a Single Line. We furnish the Hoists with or without Motors. We use Motors of prominent make such as the General Electric, Westinghouse or their equal. The Hoists are built in types necessary for all purposes.



Write for Bulletins Nos. 240, 267 and 268.

Manufactured by

ORR & SEMBOWER, Inc.
READING, PENNA.

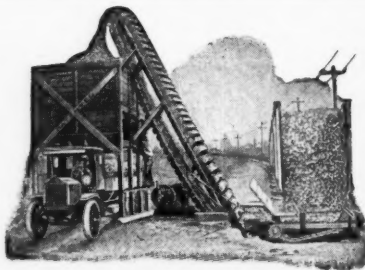
Established 1885

50 Church St.
NEW YORK CITY

208 N. Clinton St.
CHICAGO, ILLINOIS

Here's What We GUARANTEE

When equipped with proper size feeder, the **SUNBURY** Automatic Unloader



**Will load or unload a
50-ton car in 90 minutes!**

The **SUNBURY**
Automatic Unloader

And one man can handle it. The first cost is reasonable and its return from the standpoint of its being able to substantially increase your profits makes it a very profitable investment.

Its automatic feature is important and will commend it to you. It is simple in construction, strongly built and economical in operation.

We will be pleased to send you an illustrated descriptive circular.

THE SUNBURY MANUFACTURING CO.
SUNBURY, OHIO

LIDGERWOOD HOISTS

Electric—Steam—Gasoline



SCRAPERS DRAG LINE

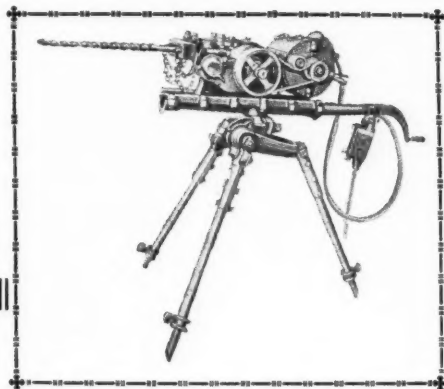
Small electric outfit
used by the Luzerne
Cement Products
Co., at West Nanti-
coke, Pa.

The outfit shown is an efficient low priced rig for oper-
ating on medium size pits, giving a big output for its
size, at extremely low cost.

LIDGERWOOD MFG. CO., 96 Liberty St., New York

Chicago; Pittsburgh; Philadelphia; Detroit; Los Angeles; Seattle; Tacoma; Portland, Ore.; Brown-
Marx Bldg., Birmingham, Ala. Sales Agents: Norman B. Livermore, San Francisco; Woodward,
Wight & Co., New Orleans, La.; John D. Westbrook, Inc., Norfolk Va.; Cameron & Barkley Co.,
Jacksonville, Miami, Tampa, Fla.; Riechman-Crosby Co., Memphis, Tenn. Canadian Allis-Chalmers,
Ltd., Toronto. Foreign Offices: Sao Paulo, Brazil; Rio de Janeiro, Brazil; London, Eng.

1700 BLOWS A Minute



With the

FORT WAYNE ELECTRIC ROCK DRILL

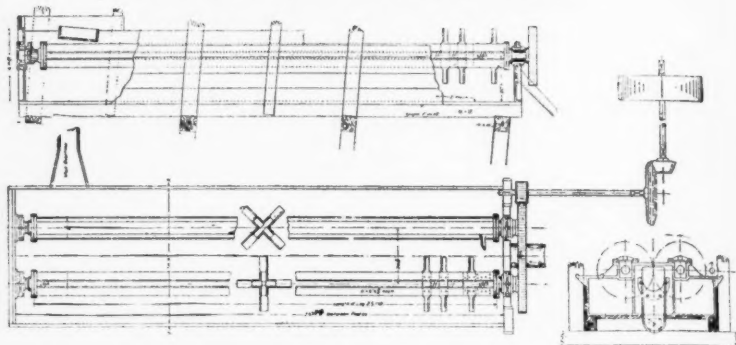
The most economical type of
drill for quarry operations.

DIAMOND MACHINE COMPANY
MONONGAHELA, PENNA.

Write
for
Catalog

YOUR MATERIALS SHOULD BE WASHED

McLanahan Double-Log Washer



We also manufacture Cylinder Washers, Elevators, and Single Roll Crushers, Special Machinery made to order.

McLANAHAN-STONE MACHINE CO.
HOLLIDAYSBURG, PENNA.



PIONEER Back Dump Bucket

has solved many problems. Very simple to operate.
Let it help you. Send for Catalog "X".

PIONEER BUCKET CO.
1011 Fletcher Trust Bldg., Indianapolis, Indiana

60 Well-Points

LAWRENCE MASSA pipe line contractor of Huntington Park, California, has three Novo Diaphragm Pumps. Two of them are shown in the picture at the right.

One Novo is connected to a string of 60 well-points. As trench excavation went forward, a section of the 4-inch main was disconnected at one end, brought forward and again connected.

The Novo pump was not stopped and operations continued without interruption.

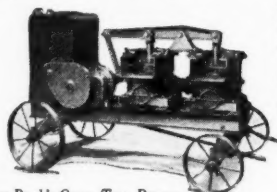
Mr. Massa has recently purchased the third Novo pump, a double open top unit. He says, "It proved to be the best of any I have used. It is a steady pumper, always ready for work. I am well satisfied with it." Novo Diaphragm Pumps, single and double, open and closed tops, have many advantages not found in other makes of pumps. Some of these are listed below.

Powered with Novo 1½, 2, 3, 4 H.P. single cylinder and 3-6 H.P. two cylinder gasoline engines.

Independent reducing gear on two cylinder engine unit. Oil tight and dirt proof. Oil automatically fed to bearings. Cleanout and drain in pump base. Machine cut gears in bath of oil.

Double threaded discharge flange. Specially made diaphragm outlasts several ordinary diaphragms.

Other features, all illustrated and described in Data Sheets Nos. 99 and 105. Write for complete details.

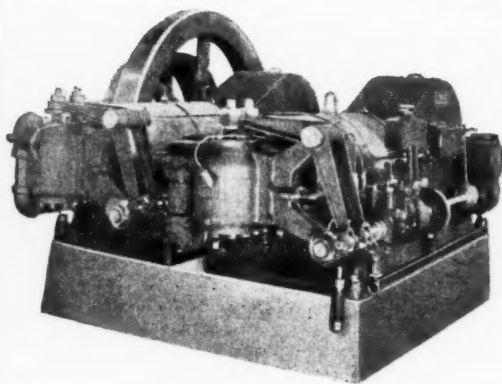


Novo Double Open Top Pump with 2 cyl. Novo UF Engine.

NOVO ENGINE CO.
Clarence E. Bement, Vice-Pres. & Gen. Mgr.
LANSING — MICHIGAN



A Pronounced Economy Four Cycle—McEWEN—Oil Engines Exhaust Completely Start Quickly



Economical—The four-cycle principle of operation permits the engine to exhaust completely the burnt gases before taking a charge of intake air. Hence no carbonization or overheating.

Easy Starting—By means of a special blow torch attachment, these engines will start quickly on the same fuel they regularly burn.

McEWEN BROTHERS WELLSVILLE, N. Y.

HELICOID CONVEYOR

for Long Satisfactory Service



Caldwell Helicoid, or Continuous Flight Conveyor, rolled from a single strip of metal and with an extremely strong flight, has no laps or rivets. This means: Non-interference with the normal flow of materials, added strength, ease in cleaning, and longer life.

If you need elevating, conveying or transmission machinery promptly, address Caldwell, or nearest Link-Belt office.

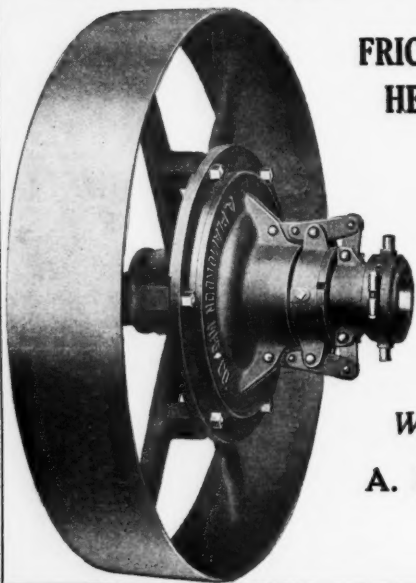
H. W. CALDWELL & SON CO.

LINK-BELT COMPANY, OWNER

Chicago, 1700 S. Western Ave.; New York, 2676 Woolworth Bldg.; Dallas, 810 Main St.

CALDWELL

IMPROVED PLAMONDON



**FRICTION CLUTCH PULLEYS
HEAVY WORKING PARTS**

Now Made of Steel

**DEPENDABLE GEARS
CUT or CAST TEETH
STEEL or CAST IRON**

**General Machine Repairs
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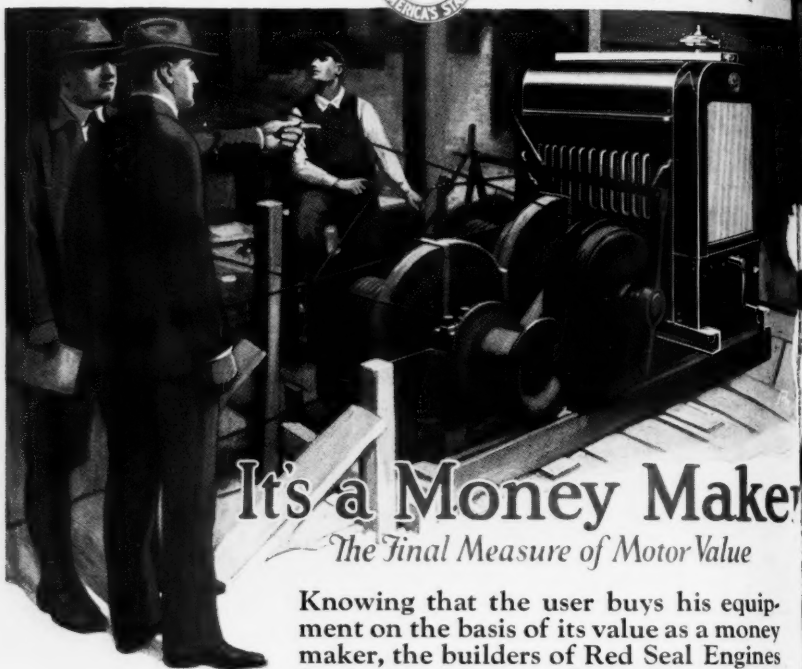
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